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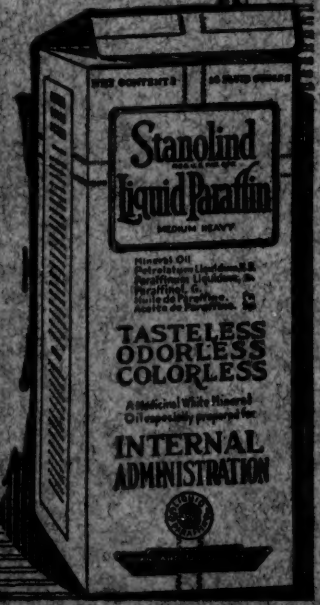

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ANNALS *of* SURGERY

VOL. LXIII MAY, 1916 No. 5

SUGGESTED OPERATIVE STEPS DEALING WITH SPONTANEOUS INTRACEREBRAL HEMORRHAGE (APOPLEXY)*

BY CHARLES M. REMSEN, M.D.
OF ATLANTA, GA.

IN all cases of spontaneous intracerebral hemorrhage there are three indications: (1) To relieve the general increased cerebral pressure subsequent to the escape of unconfined blood under high pressure into the cerebral tissue, this pressure then being transmitted to the neighboring tissue resulting in marked physiological disturbances; (2) to relieve localized direct pressure upon the internal capsule, disturbances or destruction of which lead to severe projection symptoms; and (3) to prevent extension of the cerebral excavation by hemorrhage.

The first of these indications involves procedures intended to tide over a temporary period during which the intracranial pressure may be so great as to interfere with the proper functioning of the cardiac and respiratory centres, which interference, if allowed to continue, in the natural course of events may, as is so often seen, terminate fatally.

For the second of these indications, steps are planned to relieve the local pressure upon the delicate fibres of the internal capsule, and thus prevent the transformation of a physiological block into destructive laceration or pressure atrophy, either directly due to the reactive œdema about the hemorrhage or to the pressure of the hemorrhage itself.

The third indication calls for methods by which the hemorrhage is prevented from burrowing down the brain stem, out to the cortex, or into the ventricles, processes which may lead to serious disturbances, nuclear involvement, hemianopsia, or disturbed function in almost any portion of the brain, and, if allowed to pursue its course without intervention, may be the direct cause of death.

Thus it will be seen that these procedures not only serve to prevent an immediate fatal ending, but also to prevent or alleviate the paralyses

* Reported at the October, 1915, meeting of The Atlanta Neurological Society.

considered almost an essential sequela of the apoplectic stroke, and which may be complete as a result of too long continued physiological disturbance.

A study of the pathology of spontaneous intracerebral hemorrhage indicates that these results may be best accomplished in a large percentage of cases by confining our field of activity to a certain fairly well-defined area, and the method of intervention as suggested here and employed by us[1] is given below in a series of sketches which from their text may be easily understood.

It is seen that these principles not only involve decompression, as has been suggested before, with the idea of relieving an otherwise possibly fatal intracranial pressure, but also involve the evacuation and drainage of the hemorrhagic cavity, with a view (1) toward eliminating the

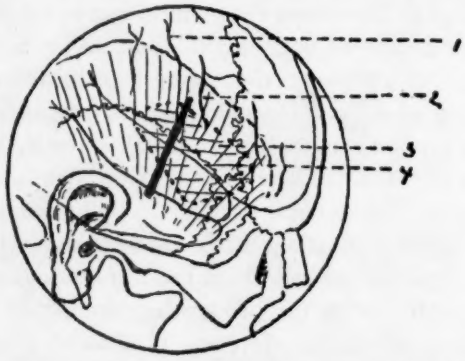

FIG. 1.—Semi-transparent sketch showing the relative anatomy of the island, Rolandic fissure, temporal muscle to the cranium. Heavy lines show line of incision. 1, fissure of Rolando; 2, line of incision; 3, surface projection of the island; 4, upper boundary of the temporal fossa.

continued excavation of the hemorrhage from the striate body elsewhere into more important structures; (2) toward relieving the direct pressure upon the capsule itself by this hemorrhage, and thus interfering with the appearance of permanent paralysis, the hemiplegia of apoplexy; (3) towards escaping the indirect results of the perihemorrhagic reaction, œdema, anæmia, pressure which, if continued, may cause destruction and paralysis as well as the pressure of the clot itself, and (4) towards obviating the formation of the so-called apoplectic cyst, so often formed by the intracerebral retention of spontaneous or traumatic hemorrhage.

No attempt is made to enter into a discussion here of the particular physiological, anatomical, and pathological bases for this general

[1] Remsen: Surgical Measures in Apoplexy. Report of a Case. J. A. M. A., July 10, 1915.

method of intervention [2] in this article, but merely the successive steps of the operation are indicated with the hope that this may serve its purpose in a not too small percentage of cases of intracerebral hemorrhage heretofore treated only symptomatically.

Pre-operative Treatment.—Such patients are debilitated and prone

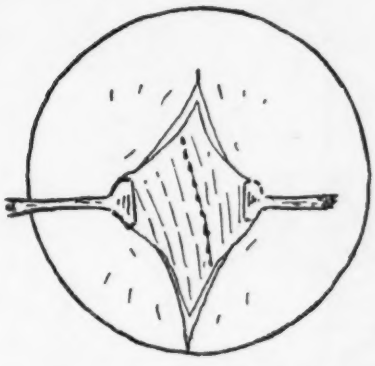

FIG. 2.—Showing skin edges drawn apart, together with the edges of the temporal fascia. The fibres of the underlying temporal muscle are seen and the dotted line represents the line of separation of these muscle fibres.

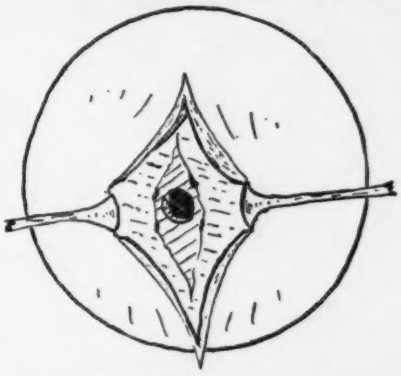

FIG. 3.—Showing the skin, temporal fascia, and temporal muscle drawn aside. The underlying periosteum has been incised and pushed aside, revealing the underlying bone. Through this a trephine opening has been made preparatory to the enlargement of this opening by the rongeurs.

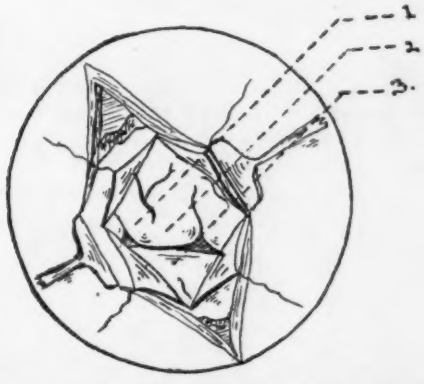

FIG. 4.—Here the skin, temporal fascia and muscle have been retracted, a larger opening made in the skull, and a crucial incision made in the dura. These dural flaps are shown being reflected. 1, par opercularis; 2, Broca's convolution; 3, gyrus temporalis superior.

to pneumonia. The administration of 1/150 of atropin is exceedingly important in order to obviate as far as possible the possibility of aspiration pneumonia. It is not at all unlikely that patients will need no anæsthesia of any sort, owing to either a semiconscious or comatose

[2] Remsen: Apoplexy. Surgery, Gynæcology and Obstetrics, December, 1915.

state. Urotropin is administered in generous doses before operating, since there will be drainage for several days of blood and cerebrospinal fluid.

Step No. 1.—The head is shaved over the entire half of the side which is to be subjected to operative procedures. The usual aseptic precautions are followed.

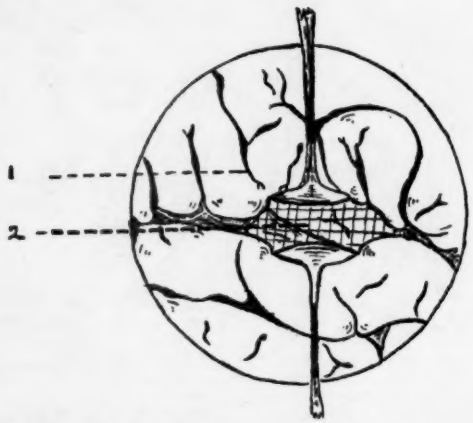

FIG. 5.—The actual seat of operation is shown in about natural size. Here the opercular borders are drawn apart, revealing the gyrus longus and the gyri breves of the surface of the insula. 1, lower end of Rolandic fissure; 2, surface of the island seen deep in the cleft (screened area).

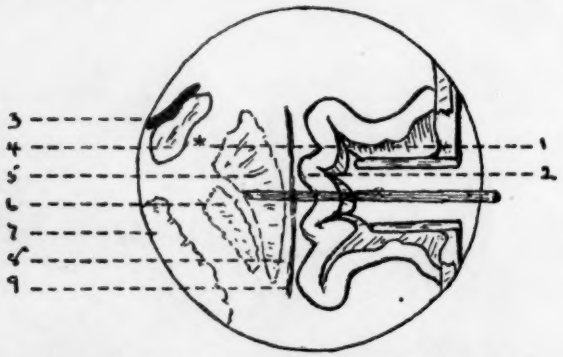

FIG. 6.—This shows a sketch of the cross-section of the field of operation. The opercular borders are shown drawn apart and the trochar enters successively the gray and white matter of the island, the claustrum, the external capsule, and the putamen. When hemorrhage is found in the region of the striate body a drain is inserted along the tract indicated by the trochar in the illustration. The opercular borders are allowed to fall together, and the drain is led out through the skin. 1, internal capsule; 2, gray matter of the island; 3, ventricle; 4, head of caudate nucleus; 5, putamen; 6, globus pallidus; 7, nucleus lateralis thalami; 8, the external capsule; 9, the claustrum.

Step No. 2.—A vertical linear incision is made anterior to and well above the external auditory meatus (see Fig. 1).

Step No. 3.—Bleeding points are carefully controlled, and the skin-flaps drawn back firmly. This exposes the temporal fascia. A similar

incision is made through the temporal fascia and these two leaves drawn back. This exposes the fibres of the temporal muscle (see Fig. 2).

Step No. 4.—The fibres of the temporal muscle are separated, not cut. Their direction may be slightly oblique to the overlying linear incision. On retracting these two edges the parietal and squamous portions of the temporal bone are exposed. Either with a burr or trephine an opening is made in the underlying bone. By retracting

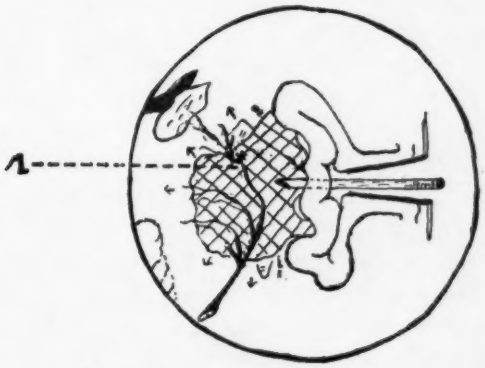

FIG. 7.—Cross-section—compare with Fig. 6. Here, screened area shows schematic representation of a hemorrhage. The trochar is seen entering this area by way of the surface of the island. 1, the arterial branch which is involved in the great majority of cases of apoplexy. The arrows show the lines of force exerted upon the internal capsule and surrounding tissue.

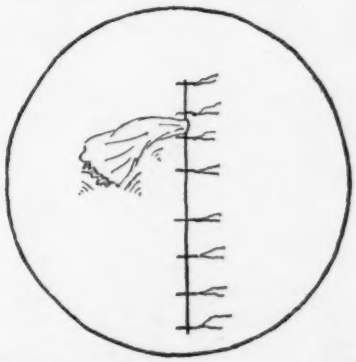

FIG. 8.—Shows the operation as completed, with the drain led out through the upper portion of the incision.

and lifting up the temporal muscle edges it is possible to enlarge this opening rapidly with the rongeur forceps. An opening is made somewhat larger than the silver dollar. The underlying dura is now exposed. The dura is opened by a crucial excision. Should hemorrhage present itself at this stage this is carefully evacuated. The underlying cortex is now inspected and the lateral cerebral fissure and the fissure of Rolando located. A thorough inspection of the cortex by means of a

brain spatula is now made, and discoloration, or other signs suggesting subcortical hemorrhage may or may not be present. Should these be present the next step is as follows (Figs. 3 and 4):

Step No. 5.—A hemorrhage is evacuated through the exploratory tract and gutta-percha drain carefully inserted through this tract to the hemorrhagic cavity. Should the cortex appear normal or, at least, only œdematous and show no signs of subcortical hemorrhage, an exploratory cerebrotomy is performed.

Step No. 6.—The opercular borders are drawn carefully apart just at, or anterior to, the points of intersection of the sylvian fissure and the projected Rolandic fissure. In the depths of this cleft the surface of the Island of Reil is located and a trochar is inserted therein for a distance of from one to three centimetres. This will penetrate the gray and white matter of the island, the claustrum, the putamen and the globus pallidus. It is in this region that one is likely to encounter free blood. Should this be encountered after one or several punctures the hemorrhagic cavity is treated in a manner exactly similar to the subcortical hemorrhage (Figs. 5, 6 and 7). (Ventricular puncture may be performed at this step, if necessary.)

Step No. 7.—The dura is folded back into place and not sutured.

Step No. 8.—The carefully guarded and uninjured edges of the temporal muscle are brought together with interrupted sutures of fine black silk. The temporal fascia is brought together in a similar manner. Several sutures are placed in the subcutaneous suture and the skin is brought together with interrupted fine black silk suture. The drain is led through the upper portion of this buffer (Fig. 8).

COMPLETE BRANCHIOGENIC FISTULA

By Charles N. Dowd, M.D.
of New York
Surgeon to the Roosevelt Hospital

The following diagram (Fig. 1), which is taken from McKenty's article,[1] suggests the general arrangement of the localities in which the different branchial arches develop.

The auditory canal develops at the site of the first cleft.[2, 3] The eustachian tube, the middle ear and the external auditory meatus would really form a complete fistula but for the membrana tympani which represents the thinnest portion of the cleft and contains two layers of epithelium, one from the ectoderm and one from the endoderm. This "near" fistula is really very similar to the real fistulæ which sometimes exist in the neck at the site of the second cleft. When maldevelopment at the first cleft occurs, it is apt to show itself by tabs in front of the ear, or defects in the ear itself, and occasionally is associated with defective formation of the mouth.

Figs. 2 and 3 illustrate this. They are photographs of a child in the Roosevelt Hospital and are similar to one figured by McKenty.

Maldevelopment at the site of the second cleft causes most of the branchiogenic anomalies which call for surgical care. These anomalies may consist of cysts, complete fistulæ, or blind fistulæ. The cysts lie in the side of the neck and are developed from sequestrations of branchial tissue. The complete fistulæ have internal openings near the tonsil and external openings at or near the anterior margin of the sternomastoid muscle somewhere between the hyoid bone and the clavicle. They are lined with epithelium, cylindrical at the inner end and squamous at the outer end. Their orifices are small. Their walls are composed of various kinds of tissue (see Fig. 5). The blind fistulæ are similarly constructed, but have single openings which may be either external or internal.

It has never been proved that complete fistulæ form either from the third or the fourth clefts (McKenty, Whitacre, König).

Complete fistulæ are not common. In looking over the records of

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[1] F. E. McKenty: Surgery, Gynæcology and Obstetrics, August, 1914, vol. xix, p. 141.

[2] Whitacre: Annals of Surgery, vol. xxxvii, p. 62.

[3] F. König: Ueber Fistula colli congenita. Archiv f. klin. Chir., Bd. li, s. 578.

the New York Surgical Society one finds no report of such a fistula. This indicates the comparative rarity of the condition, although instances of it must have been observed by many members of the Society.

The patient here presented[4] had such a fistula with well formed walls and with remarkably few adhesions to surrounding tissues. She was a healthy child of eleven years and showed no other evidence of congenital defect. Since infancy there had been a small opening at the inner margin of the right sternomastoid muscle one-half inch above the clavicle. The end of a small probe could be inserted into this opening and passed upward toward the pharynx. Colored fluid injected into it came through into the

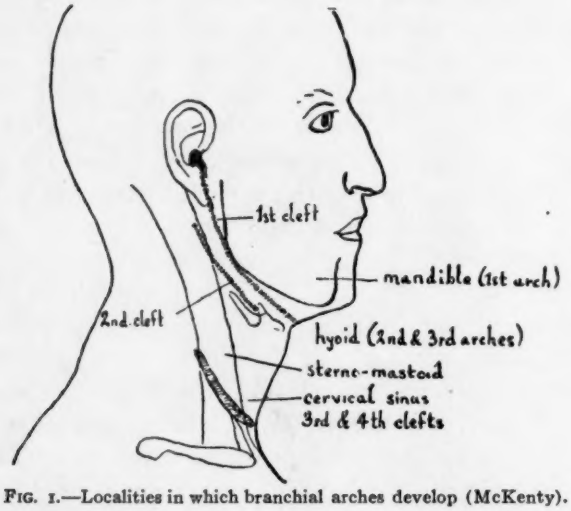

FIG. 1.—Localities in which branchial arches develop (McKenty).

mouth. Barium mixture injected into it showed on the X-ray plate a shadow of nearly uniform calibre, about one-eighth of an inch in diameter, running beside the trachea upward to the pharynx. The external opening was so small as hardly to be noticeable, but an annoying mucoid discharge came from it.

Operation.—On October 16, at the Roosevelt Hospital, under ether anæsthesia, a ureteral catheter was passed through the external opening upward to the region of the hyoid bone. An incision was then so made as to leave a disk of skin about the margin of the opening and to extend upward and backward nearly to the angle of the jaw. Flaps including the platysma were then separated on each side and the wall of the sinus was exposed to view—it lay on the deep fascia parallel to the sternohyoid muscle

[4] Case presented to the New York Surgical Society, November 24, 1915.

FIGS. 2 and 3.—Photographs of child showing maldevelopment at the site of the first branchial cleft: defective ear, pre-auricular tabs, and defective mouth fissure.

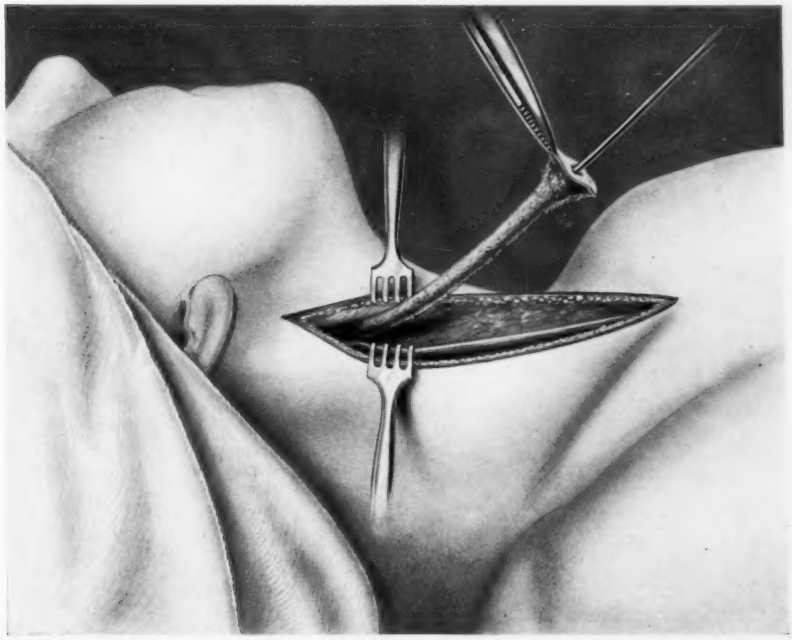

FIG. 4.—Sketch showing the appearance of the branchiogenic fistula during operation. The lower part of the wall of the fistula was easily separated from the deep fascia upon which it lay. When it was abducted a ureteral catheter passed easily through its lumen into the pharynx, close to the tonsil.

FIG. 5.—Microphotograph of transverse section of wall of complete branchiogenic fistula near its inner end. *A*, columnar epithelium; *B*, lymph follicles; *C*, strands of unstriped muscle tissue *D*, fibrous tissue; *E*, areolar tissue; *F*, bundles of striped muscle.

and was astonishingly distinct. It resembled a large vein but was not dark colored. It was easily separated from the fascia as far upward as the hyoid bone and then presented the appearance shown in Fig. 4. When its lower end was abducted the ureteral catheter passed easily into the pharynx near the lower end of the tonsil. The upper part of the sinus wall was then separated from its attachments close up to the pharyngeal muscles. It passed beneath the anterior belly of the digastric muscle. Its attachments were so lax that neither the hypoglossal nor glossopharyngeal nerves were seen. The separation was so satisfactory that the inversion of the upper end of the tube into the pharynx seemed possible (as suggested by Von Hacker[5]). The fistulous tube was therefore cut off about three-quarters of an inch from the pharynx and a stitch taken in the distal end of the remnant and fastened to the catheter. The catheter was then withdrawn through the mouth and the end of the fistulous tube following it was inverted into the pharynx. It frayed away and separated at the margin of its pharyngeal opening. Its complete removal was therefore accomplished.

This procedure is, of course, the ideal one, since it completely removes the epithelium of the sinus and the embryonic wall which includes it. The procedure, however, is not always possible. Operation records show that there is considerable variation in these fistulæ. McKenty states that "if the development of the vessels be normal, a fistula of the second cleft must lie between the external and internal carotids." This corresponds to the embryology of the part, for the cleft lies between the embryonic external and internal carotid arteries. But the very existence of a fistula bespeaks abnormality and variations in position are not to be wondered at. Karewski[6] and König[7] have given very careful descriptions of some of these fistulæ and have found their walls densely adherent to the great vessels of the neck. It was impossible to dissect them away without destroying important neck structures—a procedure which the primary condition did not justify. A similar condition existed in a secondary case which the writer has operated upon. The sinus led to a conglomerate mass of tissue in the region of the carotid bifurcation.

On the other hand, Von Hacker and Whitacre have described cases similar to the one here reported. The sinus walls were loosely attached to the surrounding tissue and could easily be loosened well up to their

[5] Von Hacker: Centralblatt für Chirurgie, 1897, p. 1073.
[6] Karewski: Virchow's Archives, Bd. cxxxiii, p. 248.
[7] König, F.: Archiv für klin. Chirurgie, Bd. lxx, p. 1009.

pharyngeal openings. In the writer's case the position of the external carotid artery was carefully noted. It was behind and not in front of the fistula and was not attached to its wall. Hence, we find that fistulæ with similar external and internal openings differ much in their median attachments and hence in the difficulty of their removal.

For the adherent cases, König has devised an ingenious method of treatment. He frees the distal end of the fistulous tube as far as he can and then passes this free end through the mucous membrane in front of the tonsil and stitches it there, thus leaving a curved sinus with an internal opening at each end—the posterior one pharyngeal; the anterior one buccal.

The structure of the walls of these fistulæ is complex and interesting. At the inner part they correspond to the pharyngeal structures, usually showing columnar epithelium, fibrous and areolar tissue, lymph follicles and strands of muscle tissue; a combination which harmonizes with their embryonic origin. At the outer part the epithelium is squamous and at the very end it blends into the structure of the skin. The wall of the outer part of the sinus is usually less developed than that of the inner part and contains no lymph follicles.

Fig. 5 represents a section of wall of this fistula near its inner end. Dr. Mortimer Warren, Pathologist of the Roosevelt Hospital, has reported upon it and has identified the structures as they are described beneath the figure. In a section taken near the external opening he found a lining of squamous epithelium surrounded by a wall of fibrous tissue which showed marked round-cell infiltration. This wall was less definitely formed than that of the inner end. It contained no lymph follicles.

THE SURGICAL TREATMENT OF SUPPURATIONS IN THE POSTERIOR MEDIASTINUM

By Vincent Gaudiani, M.D.

of New York

visiting surgeon, italian hospital

The treatment of suppurations in the posterior mediastinum is still one of the most perplexing problems with reference to surgical technic. This is partly due to the relative difficulties of diagnosis for which patients are referred to the surgeon in a precarious state and to the seriousness of the operative procedures which have been advised. Two methods are known for opening and draining retromediastinal abscesses.

First, the dorsal mediastinotomy proposed and described by Nassilow in 1888.

Second, the cervical mediastinotomy (collar mediastinotomy, von Hacker).

As I had occasion, in my service, to treat surgically two cases of suppuration in the posterior mediastinum, I think it worth while to go into the history and literature of both operations.

The researches which Nassilow made on the cadaver had for their purpose not only the draining of purulent collections, but chiefly the performing of operations on the organs contained in the posterior mediastinum, as the removal of foreign bodies and the resection of the œsophagus. The importance of such operations, as Kocher states, is greatly diminished in view of the progress of endoscopic methods and development of anæsthesia under positive or negative pressure. The field of Nassilow's operation remains chiefly limited to the treatment of suppurations of whatever origin.

With the cadaver placed on the abdomen, Nassilow would diagram a musculocutaneous flap on the left side, which he dissected either centrally or laterally according to the place, high or low, where he performed the operation. After the resection of a few centimetres of the third-sixth ribs in the high operation or a few further down for the low operation, he dissected the pleura bluntly and penetrated deep into the mediastinum.

Quenu and Hartmann advised to perform the resection of the ribs not so near the columna. This can interfere with the view and work of the surgeon in penetrating on to the aorta and œsophagus. They made

their incision at the level of the angle of the ribs, and, by resecting two centimetres of the third, fourth and fifth ribs, could expose the hilus of the lungs and dominate the œsophagus down to the œsophageal opening in the diaphragm. In spite of the fact that the thoracic œsophagus is situated to the right of the columna, they insisted upon performing the operation on the left side on account of the special disposition of the pleura, which on the right forms a cul-de-sac behind the posterior wall of the œsophagus.

Potarca, with his work, tried to clear the question of the advisability of operating to the right or left side, and his decision concerning the advisability to operate to the right is based upon the left anatomical position of the aorta.

Bryant advised that when the operation was performed above the aorta, either the right or left side could be used, but that when the operation was performed lower down, the right side should be the side of choice.

Enderlen, after a careful discussion of the methods and a series of new researches, advised to operate (*a*) from the left when performed above the bifurcation of the bronchi, (*b*) from the right or left when performed at any point from the bifurcation of the bronchi to the diaphragm.

Heidenhain, contrary to Quenu and Hartmann and the others, recommends that the incision be made near the median line, that one or more of the transverse processes of the vertebræ be resected together with a portion of the ribs. At times the resection of a single process is sufficient to give a rather free entrance to the posterior mediastinum by a blunt dissection of the tissues along and anterior to the vertebræ. A wound of the pleura will very seldom occur.[1]

[1] While performing dissection exercises in Rome (Italy), I had occasion several times to execute on the cadaver, the Fontan-Ménard operation for the drainage of the vertebral bodies. As both the incision and the first step of the operation on laminæ and ribs are almost identical to the Heidenhain's operation, I used to expose by such method the organs contained in the posterior mediastinum. By following the vertebral bodies, after two or three laminæ and nearly 1½ inches of the adjoining ribs had been resected, one could very easily dissect the pleura and have a fair view of the organs.

Such a personal experience enables me to prefer the Heidenhain technic, if I had to operate for an abscess in the posterior mediastinum, through the posterior route. I consider that the relative disadvantages, namely, the going through a thick muscular layer, the rather difficult resection of the laminæ and costovertebral joint, are balanced by the safer and easier dissection of the pleura. This, of course, is very important in operating for a suppurative case.

These anatomico-surgical considerations are indeed of great weight when the opening of the posterior mediastinum has for its purpose the performing of some operation on the œsophagus or bronchi. When the operation has for its purpose the evacuation of pus, then it is not necessary to expose the organs contained therein and when this is the case, either way, depending upon circumstances, may be used.

Cervical mediastinotomy has not gained a standing as the result of either operations or researches, but because of the fact that a number of cases have been successfully treated by the cervical route. Details of the technic are of secondary importance compared to the review of the few cases concerning the anatomical findings revealed either by operations or autopsies. As can be seen by the following short reports, the cases operated upon by way of the neck are not many.

The oldest one recorded is that of Lürmann:

CASE I.—A deep abscess of the left side of the neck developed as the result of an attack of pharyngeal angina. When the fluctuation was evident, Lürmann incised over the anterior border of the sternocleidomastoid and obtained about one pint of foul-smelling pus. Through the opening in the neck, the chest could be explored deeply by means of a sound. The cavity could be filled with nearly two quarts of liquid, which was verified by percussing the back. Two weeks after the operation food appeared in the wound. Patient made a slow but uneventful recovery.

CASE II (Ziembiecki).—Started with a sudden pain in the neck and disphagic symptoms. During the first few days an œsophageal sound could be passed. General symptoms: fever, fetid breath, peculiar configuration of the neck, as an increase in size without œdema, pharyngeal and laryngeal congestion.

Diagnosis.—Prevertebral septic phlegmon.

Operation.—Incision, as to perform external œsophagotomy. Collection of pus underneath the deep fascia, from which a cavity extended for twelve centimetres between the œsophagus and vertebræ, in which a piece of bone was found. Patient was fed with an œsophageal tube throughout his stay in the hospital. Was discharged with wound almost healed but with a small œsophageal fistula. The patient having begun to take food per os, returned to the hospital with a new abscess of the posterior mediastinum. An operation on the dorsal mediastinum was proposed but refused. Patient died after three months. The autopsy revealed a small fistula in the posterior wall of the œsophagus a little below the pharynx. The abscess, which had denuded and eroded the bodies of the cervical and dorsal vertebræ, extended about twelve centimetres into the chest. Purulent pleurisy and gangrene of the right pulmonary apex was found.

CASE III (Obalinski).—Patient 21 years old. After being unable to swallow anything for three days, a painful swelling appeared on the right inferior side. Temperature, 39.5° C.; pulse, 120. Œsophageal sounds could not be passed. The swollen mass was incised and pus was easily evacuated. Death occurred after a few hours. A post-mortem typical operation on the posterior mediastinum revealed an abscess in the chest which had not been drained.

CASE IV (Heidenhain).—Patient had swallowed a piece of bone. Could not state whether the bone had passed or not. For fourteen days had pain over the supraclavicular groove and painful deglutition. For the last four days, even fluids could not be swallowed. There was rigidity of the back. Radiating pains on the right side of the chest. Cough, high temperature. Transverse arcuate incision over the right supraclavicular region; sternocleidomastoid tendon severed. Retraction of the vessels so as to expose the œsophagus. The surgeon penetrated bluntly into the retro-œsophageal tissues. An abscess with necrotic tissues was found and opened, which extended nearly ten centimetres into the chest. Recovered in four weeks.

CASE V (Rasumowski).—Patient was a boy of 12 years, who had sustained a gunshot wound of the neck. The bullet penetrated from the left side above with a downward course, through the presternal muscles, thyroid gland, into the chest. At the operation an abscess was opened which extended for 15 cm. into the posterior mediastinum. The abscess was seen to communicate with the trachea through a small opening. Patient was kept in the Trendelenburg position during the after-treatment. Patient was fed through tube for the nine ensuing months. Recovery was uneventful.

CASE VI (Von Hacker).—Symptoms of peri-œsophageal suppuration appeared after œsophagoscopy. Gastrostomy was performed first. After this, abscess was opened with an incision along the anterior border of the sternocleidomastoid. Death occurred after six days.

CASE VII (Von Hacker).—Perforation of œsophagus in its thoracic portion from sounding. Retrosternal pain appeared soon after. The day after, patient had difficulty in breathing and swelling at the base of the neck, which swelling was neither emphysematous nor fluctuating in character. Cutaneous emphysema appeared in 24 hours. Operation as in above case. The cavity, which contained pus and gas, extended from the posterior mediastinum to the retrosternal region. The trachea and œsophagus were retracted to the left side. After three days an œsophageal fistula appeared which healed in fourteen days. The abscess was drained for months in the Trendelenburg position. A gastrostomy had been performed in advance in order to feed the patient.

CASE VIII (Cavazzani).—In this case a cervical operation was at first performed. After three months, in order that a better drainage might be effected, a dorsal mediastinotomy was done on the left side. An œsophageal fistula was also present in this case.

PERSONAL CASES

CASE IX.—A. Faravino, admitted to the Italian Hospital May 23, 1913. Discharged June 1, 1913. Man of 62 years, suffering from diabetes. Condition started 25 days ago with pain on left side of neck and difficulty in swallowing. Gradually became worse until only fluids could be swallowed.

Physical State.—A swollen mass was felt at the base of the neck. The left sternocleidomastoid was made prominent by a mass which appeared anterior, and was fluctuating in character. Temperature 102°.

Operation.—Under local anæsthesia, a three-inch incision was

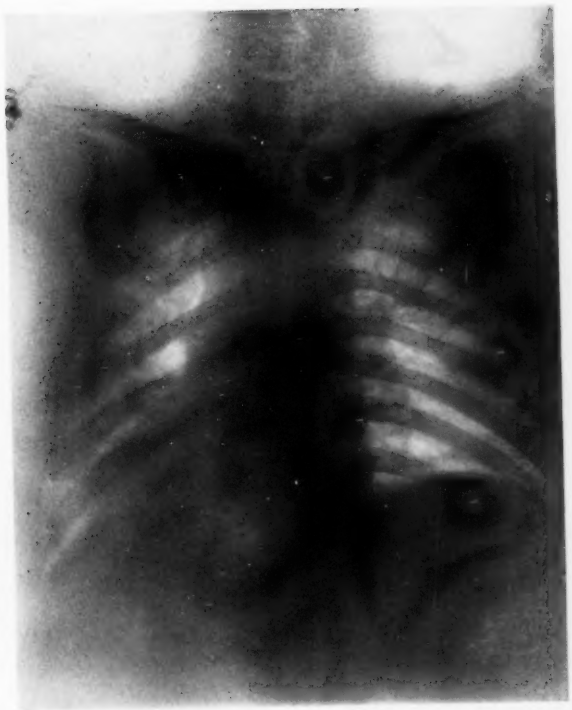

FIG. 1.—Radiograph of Case X, taken just before operation.

made along the anterior border of the sternocleidomastoid. A considerable amount of pus and necrotic tissue was found and evacuated from under the deep fascia. After this had been done, and the cavity cleared, said cavity seemed to extend behind the œsophagus as far down as a finger could explore. A drain of from six to seven inches long was necessary to reach the most dependent portion. The œsophagus appeared normal in every respect except that it was completely separated from the anterior surface of the vertebræ. A counter-opening along the posterior margin of the sternocleidomastoid was effected and large rubber drains were inserted, after which the patient was placed in the Trendelenburg position for several days. The day after operation he could swallow freely and he began to expectorate a blood-tinged sputum. Patient was discharged with a clean, granulating wound and was treated at his home by the house physician, Dr. Petillo. Wound healed in about two months. Died a year after operation from diabetes.

CASE X.—P. De Girolamo, age 40 years. Admitted to the Italian Hospital, July 17, 1915. A week before admission patient swallowed a small fishbone which imbedded itself into the upper part of the œsophagus. After a few days, dysphagic symptoms appeared and during the last few days only fluids could be swallowed. Temperature on admission 102°.

Physical State.—A well-built man, muscular and robust. Base of neck symmetrically enlarged on both sides with signs of stasis in the veins of both head and neck. Palpation over both supraclavicular fossæ, painful. Passage of a stomach tube impossible.

Blood count: Total white count, 8050. Differential of 200 cells: Polymorphonuclears, 79 per cent.; small lymphocytes, 18 per cent.; large lymphocytes, 2 per cent.; eosinophiles, 1 per cent.

Laryngoscopic examination: Negative.[2]

Ice-bag was kept on neck continuously. Chill at 2 A.M. of next day, lasting 15 minutes.

July 19, afternoon: Condition worse. Base of neck very much enlarged, painful to both deep and superficial palpation. Increased stasis and cyanosis of both face and neck. Breathing normal.

Blood count: Total white count, 8000. Differential of 200 cells: Polymorphonuclears, 80 per cent.; small lymphocytes, 17 per cent.; large lymphocytes, 2 per cent.; eosinophiles, 1 per cent.

Examination of heart and lungs did not reveal anything.

Maximum temperature, 102°.

X-ray examination: The mediastinal shadow has considerably increased in size and lost the normal conical shape (Fig. 1).

[2] Performed by Dr. Baldereschi, who kindly referred the case to me.

Operation.—July 19, 4.30 P.M., 1915, nearly 48 hours after admission. After anæsthetizing the part with novocaine-suprarenin, an incision was made over the anterior margin of the sternocleidomastoid, as for the typical exposure of the œsophagus. As soon as the skin and subcutaneous tissues were cut, patient became cyanotic and symptoms of sudden asphyxia arose. After provisory clamping of blood-vessels and covering the wound, a low tracheotomy was performed. As soon as this was done, fetid mucus escaped from the wound. A tracheal cannula was inserted and general anæsthesia was given through same. Then the interrupted operation was resumed as follows: The œdematous œsophagus was rather easily recognized and exposed. The carotid artery was separated and retracted externally, while the left lobe of the thyroid gland was elevated. With the œsophagus clearly in sight, the posterior mediastinum was penetrated by blunt dissection. As soon as the Kocher dissector was introduced behind the œsophagus, a stream of fetid pus appeared, which was rapidly aspirated by suction. The small opening was further enlarged downward until three fingers could freely penetrate a large cavity, the bottom of which could be sounded by a Pool's sucker. With my fingers introduced I could follow the œsophagus and feel the pulsation of a very large vessel (arch of the aorta). On examining the cervical œsophagus, a small purulent spot (about size of the head of a pin) could be seen on its external side and one inch below the pharynx. Iodoform gauze drainage effected, with patient in the Trendelenburg position.

On the 20th, at 2 A.M., the temperature reached 106° F., pulse 140, and respiration 32. At 2.30 P.M. of the same day the dressing was changed. The tracheal cannula was removed and the wound cleaned with peroxide. Patient could swallow freely, no fluid coming through the œsophagus. The condition became worse as night approached, when the temperature reached 107°, pulse 166 and respiration 44. Patient died at 7.45 A.M., of the 21st July.

Autopsy by Coroner's physician (Weinberg).

After the lungs had been removed, a cavity which reached as far down as the arch of the aorta was exposed the wall of which was covered with necrotic tissue but entirely free from pus. Lungs showed a diffuse bronchopneumonia. Upon opening the larynx and trachea, there could be seen a diffuse necrosis of the mucosa which extended down the bronchi. On the posterior wall of the trachea, nearly one inch under the cricoid cartilage, a small ulcerative perforation was found which allowed of entrance of a probe. The mucosa lining the œsophagus was apparently normal.

It can be seen that my two cases do not both belong to the same class. The first case showed a chronic type with severe local, but very mild general symptoms, and case two was characterized by both very severe local and general symptoms. In Case I the object of the operation was to drain an abscess which gave symptoms of pressure of the œsophagus and which I thought was located under the deep cervical fascia. Only the operation (as in the cases of Lürmann, Rasumowski and Obalinski) revealed the existence of a retro-mediastinal cavity.

In Case II a correct diagnosis was made before operation. Therefore I had in mind, as in the other cases above reported, to reach the focus, through the cervical route (collar mediastinotomie, Von Hacker).

The origin of the abscesses in both these cases was very probably from the œsophagus, although neither operation nor autopsy gave proof that this was the case. In Case I a bloody expectoration appeared as soon as the abscess was opened, indicating very probably an ulceration of the œsophagus.

In Case II the patient gave a history of having swallowed a very small fishbone a week before admission. At operation a small abscess was found on the exterior coat of the œsophagus, one and one-half inches below the trachea on the left side. Although no trace of the lesion was found in the mucosa at autopsy, it is fair to assume that a tiny fishbone migrated through it into the posterior mediastinum.

That the opening in the trachea in Case II was a secondary occurrence seems to me more than certain, inasmuch as the primary and successive symptoms were only of a dysphagic nature. No symptoms of dyspnœa were present until a little before operation and no trace of the foul odor which we perceived when the trachea was opened had until then been perceptible. The cause of death was due to an acute bronchopneumonia *ab ingestis*. In Case I, which was under my care for two weeks, I was prepared to drain the abscess from the dorsal route, having been instructed by the Cavazzani case, but this proved to be unnecessary.

Altogether, the cases of abscesses in the posterior mediastinum reported in the medical literature, in which a cervical operation was performed, with my two new ones, are ten, including the Cavazzani case, in which a dorsal operation was performed months after the cervical.

Five cases (Lürmann, Rasumowski, Von Hacker, Heidenhain, Gaudiani) were cured by the cervical operation. One (Cavazzani) was cured by the cervical plus the dorsal operation. One (Ziembiecki) can be considered among the cured, as the patient died when already

in a very good condition—started to swallow food through the mouth, instead of through the œsophageal tube. One can say that seven times out of ten, cervical mediastinotomy was successful, applied in the treatment of abscesses in the posterior mediastinum. If we do not consider among the unsuccessful cases the Ziembiecki case, we find three deaths. In all these cases the operation had reached and drained the pus cavity. In all three, the general condition, on account of the sepsis, was exceedingly bad, so that the posterior operation would have certainly hastened the fatal result. As I have already stated, it is probable that in my case the cause of death was due to pneumonia and this due to the opening of the abscess in the trachea a little before the operation was performed. Therefore the clinical experience does not justify what Ziembiecki, as a result of his case, proposes: *that indiscriminately in each case a cervical and dorsal operation must be performed,* as this appeared to be necessary only in the Cavazzani case, while in all the rest the cervical operation was sufficient and in a few the dorsal route could not have helped at all.

There is no question but that in many cases the cervical incision may not allow of a successful drainage, but even then such an operation may cause the acute septic symptoms to disappear, do away with their sequelæ, and give time for a better localization of the cavity and the place where to perform the dorsal operation.

There are no special details in the operative technic to be described. In the majority of cases an incision as for the exposure of the cervical œsophagus is performed. The œdema or emphysema of the superficial tissues may make the operation more difficult. When the œsophagus is widely exposed, the vessels of the neck are strongly retracted laterally while the thyroid gland, which may be in the way, is elevated. Care must be taken not to injure the arteria thyroidea inferior. By blunt dissection, the œsophagus is separated from the bodies of the vertebræ and a way is easily found leading into the posterior mediastinum.

Heidenhain performed such an operation with a transverse incision. In one of my cases, two incisions were used, one anterior to and the other posterior to the sternocleidomastoid to insure of better drainage. The Trendelenburg position for several days and aspirative drainage are very valuable.

Another technical point is how to deal with œsophageal perforations. The performing of a gastrostomy in every case, as advised by Von Hacker, cannot be accepted, as sometimes a perforation of the œsophagus does not exist, even when the abscess had its origin from

that organ. Gastrostomy could prove to be in several cases an unnecessary procedure in an already weak patient. Therefore I think it wise to drain the abscess without paying any attention to the possible lesions of the œsophagus, unless an actual perforation appears in the operative field. In such a case, an œsophageal tube must be introduced through which the patient can be fed. Afterward, one may decide whether it is better to perform a gastrostomy or to continue feeding through the tube until the healing of the abscess has occurred. When no real lesion of the œsophagus is noticed at the operation, the wound is carefully watched for the appearance of food, in which case, according to circumstances, a gastrostomy or œsophagostomy is performed.

CONCLUSIONS

Abscesses in the posterior mediastinum must be treated by incision through the dorsal or cervical route.

All abscesses located at any point in the posterior mediastinum may be dealt with by the dorsal incision, but its real indication is for cavities located low in the mediastinum below the arch of the aorta from the fourth to fifth dorsal down.

All abscesses situated at the level or above the fourth dorsal may be successfully opened and drained through a cervical incision. Only secondarily a dorsal mediastinotomy may be necessary.

Cervical mediastinotomy has a rather wide range, principally because of the fact that many abscesses have their origin from the superior portion of the œsophagus or from the retro-pharyngeal space and only secondarily migrate in the chest.

Abscesses whose origins are in the superior part of the mediastinum have, according to Von Hacker, no tendency to spread downward. Because of the lessened density of the cellular tissue above the heart, they easily migrate toward the neck.

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REMOVAL OF BULLET FROM PERICARDIUM

REPORT OF A CASE

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On November 1, a French Zouave, while advancing with his company in a crouching position to take a block-house, was hit by a rifle ball which entered about 4 cm. to the left of the first dorsal vertebra. The impact knocked him down; he expectorated some blood, and, after remaining on the ground until the assault was over, he worked his way back to the trench. He suffered little or no pain. He was taken to the Field Hospital where he was retained for some time, and was afterward transferred to a Base Hospital, where an X-ray picture was taken which showed the bullet in the same shadow with the heart. Fluoroscopic examination disclosed that every time the heart beat the bullet moved with it.

The wound at the point of entrance healed readily and the patient suffered no great discomfort, the hemorrhage from the lungs ceasing after a few days.

He was admitted to the American Ambulance Hospital of Paris, February 17, 1915, about three and one-half months after being wounded. At the time he came under our observation, examination showed a well-nourished young man, twenty-one years of age, with a healed wound in the back. Patient was in no pain, his chief complaint being that when walking or exercising he quickly became fatigued and experienced shortness of breath.

A second X-ray examination showed the shadow of the bullet lying near the apex of the heart and pointing upward and inward (Fig. 1). Fluoroscopic examination showed the bullet moving in a rotary manner with each heart-beat. The patient's temperature was 99, his pulse 90. It seemed that the position of the bullet was responsible for the dyspnœa and that in some way it was mechanically interfering with the heart's action. After keeping him under observation for a week, I decided to attempt the removal of the bullet.

Operation.—Under nitrous-oxide-oxygen anæsthesia, a rectangular flap was made, as shown in the cut (Fig. 2, *A*). The skin together with the muscles was dissected free from the ribs and the flap turned outward (Fig. 2, *B*). The vertical incision extended from the attachment of the fourth rib to that of the sixth and seventh ribs. The fourth, fifth and sixth ribs were cut at the cartilaginous attachment (Fig. 2, *C*) and the intercostal muscles

divided midway between the fourth and fifth ribs (Fig. 2, *D*). Then by careful dissection the ribs were elevated, exposing the internal mammary artery which was not cut. By retraction the pleura and pericardium underneath were exposed, the exposure being quite ample for further manipulation (Fig. 2, *F*). By palpation I was then able to detect the bullet, the point of which had passed through the pericardium, the base apparently lying just outside. The bullet moved freely with each heart-beat. It was impossible to tell how deeply it had penetrated the muscle of the heart, but it did not seem as though it had gone deep enough to enter the left ventricle. The tissues on either side of the bullet were grasped with forceps to steady it sufficiently to make an incision, and then a cut was made over the base of the bullet. The bullet was then grasped with hæmostatic forceps and removed. It was well encysted and no hemorrhage followed its removal.

It did not seem advisable to make any further exploration or to try to suture over the opening. A small amount of old, washed-out blood escaped with the bullet. In elevating the ribs the pleura was opened and there was a collapse of the lung, but little disturbance resulted from this. There was practically no hemorrhage in the whole operation. The intercostal arteries were not disturbed nor was the internal mammary in danger. The intercostal muscles were sutured with mattress sutures of chromic catgut and the cartilage was sutured to the sternum by single ties (Fig. 2, *G*). The cartilaginous ends were sewed with chromic catgut and were easily held in place. A small cigarette drain was placed in the wound for drainage in the event of oozing.

After two days the patient developed a pneumonia on the right side and had a rather stormy time for a few days. Later, when the left lung began to expand, a similar condition began on the left side and this was followed by effusion which later necessitated the resection of a rib and drainage. He rapidly recovered from this and made a complete recovery.

On May 3, I had a letter from him, enclosing a photograph showing that he was up and about, and except for a small sinus was in good condition.

The principal feature to which I wish to call attention is the method of approach which was made in this case; that is, the division of the cartilaginous attachment to the ribs and of the muscles between the ribs, so as to make, by retraction, a "V" exposure. By this method ample room is secured and the ribs are not fractured, a circumstance which retards convalescence and makes it much more painful. With this exposure it would have been quite possible to have done any further work which might have been necessary on the heart muscle itself.

FIG. 1.—X-ray photograph showing shadow of bullet lying in the apex of the heart.

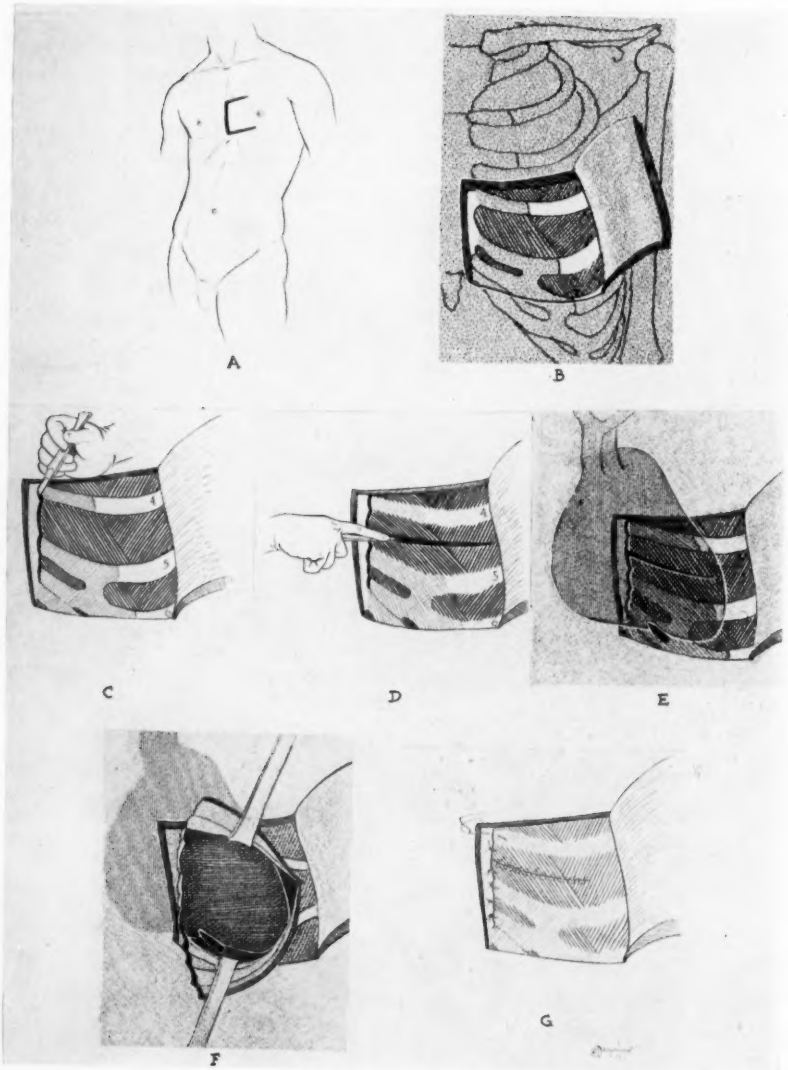

FIG. 2.—Schematic drawings illustrating various steps in the operation for the removal of bullet from pericardium.

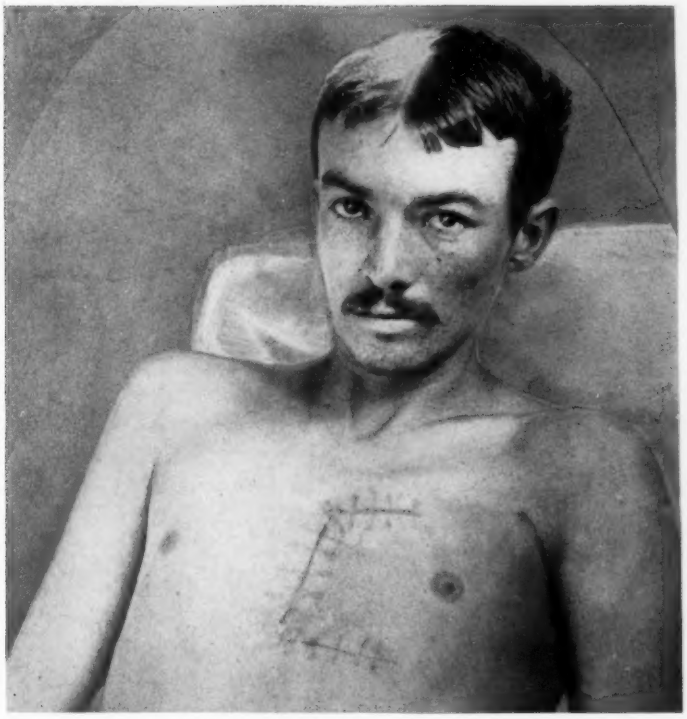

FIG. 3.—Patient during convalescence after removal of bullet from pericardium, showing line of incision.

FIG. 4.—Patient after recovery from operation for removal of bullet from pericardium.

INTRAHEPATIC CHOLELITHIASIS

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Intrahepatic cholelithiasis, *i.e.*, accumulation of stones in the main branches of the hepatic ducts and in its ramifications, is a well-known and not extremely rare finding in the dissecting room. The medical literature comprises about 250 cases of this disease. Beer, in 1904, published a very thorough study of this condition. He dissected 250 livers of patients who had died of gall-stone diseases and found intrahepatic cholelithiasis in 6 cases (about 2.5 per cent.). It is most surprising that in our modern era of operative surgery, comprising every year innumerable operations on the biliary system, a typical case of intrahepatic cholelithiasis has never been reported from an operating room. The only possible explanation for this condition of affairs is that the disease, on account of its rarity, was not properly diagnosed by the surgeon.

I had the rare occasion to operate upon a case of intrahepatic cholelithiasis in which I could make the diagnosis on the operating table. This case presents a surgical unicum, and I think that its rarity warrants a rather detailed report.

S. R., thirty-one years of age, tailor, was admitted to the Beth Israel Hospital on November 19, 1914.

Family History.—Negative.

Previous History.—Patient had typhoid fever sixteen years ago and an attack of jaundice fourteen years ago. He has been perfectly well since that time.

Present Illness.—One day before admission to the hospital the patient was seized with abdominal cramps. These pains lasted about three hours and were referred to the shoulder. He had nausea and vomited twice.

At 11.30 this morning, while walking, he was again seized with abdominal cramps, also referred to the right shoulder. The pain is continuous. He had a chill lasting three-quarters of an hour, felt feverish, did not vomit.

Physical Examination.—Marked tenderness about one inch below the right costal margin. Peritoneal irritation elicited on

right side of abdomen. Tenderness at McBurney's point. Marked rigidity on the right side of abdomen, less on left side.

We were evidently dealing with an acute inflammatory process in the right hypochondrium.

Pre-operative Diagnosis.—Acute gangrenous cholecystitis or perforated duodenal ulcer.

Operation (November 19, 1914) (Lewisohn).—Right rectus incision three inches long. On opening the abdominal cavity a gush of turbid, yellow fluid escaped from the upper abdomen. The amount of free fluid was rather large. The gall-bladder was distended to about twice its normal size, not tense; its walls were thin and showed no external signs of inflammation. The stomach protruded through the incision and was so distended that a stomach tube was passed to expose the field; the stomach contained a large amount of clear fluid. The stomach itself was normal and a careful examination of the duodenum failed to show any sign of ulcer or perforation. There was a moderate amount of fresh fibrin around the stomach.

The liver was enlarged to about one and one-half times its normal size and showed extensive adhesions between the upper surface and the diaphragm; this surface was covered with a large amount of fresh fibrin, and on separating the adhesions a moderate amount of turbid yellow fluid escaped from between the two surfaces. The whole diaphragmatic surface of the liver felt nodular; these areas were hard, some of them whitish in color. On the inferior surface of the liver, toward the anterior border, there was a markedly inflamed area belonging to the right lobe; in this part was seen a small abscess cavity, which had perforated and opened into the free peritoneal cavity. At the base of the cavity two small gall-stones were felt; the liver tissue was incised, and the stones removed (Fig. 1). Wound sutured with chromic gut (two sutures). The stones were small and black in color. The site from which they were removed was more than an inch and a half away from the attachment of the gall-bladder to its left.

The nodular diaphragmatic surface of the liver was then exposed, and one of these nodules on the right lobe, about four inches from the anterior free border, was incised; after splitting the capsule, a small hard nodule presented itself, about the size of a pea; the mass was whitish and hard (fibrous tissue?). From the centre of this mass four small, black gall-stones were removed. They were exactly like those which had been found on the under surface of the liver (Figs. 2 and 3).

A strip of gauze was inserted in this region and one to the abscess cavity on the inferior surface.

The gall-bladder was opened. It contained about thirty cubic

FIG. 1.—Perforation of intrahepatic stones at under surface of the liver, causing a localized peritonitis.

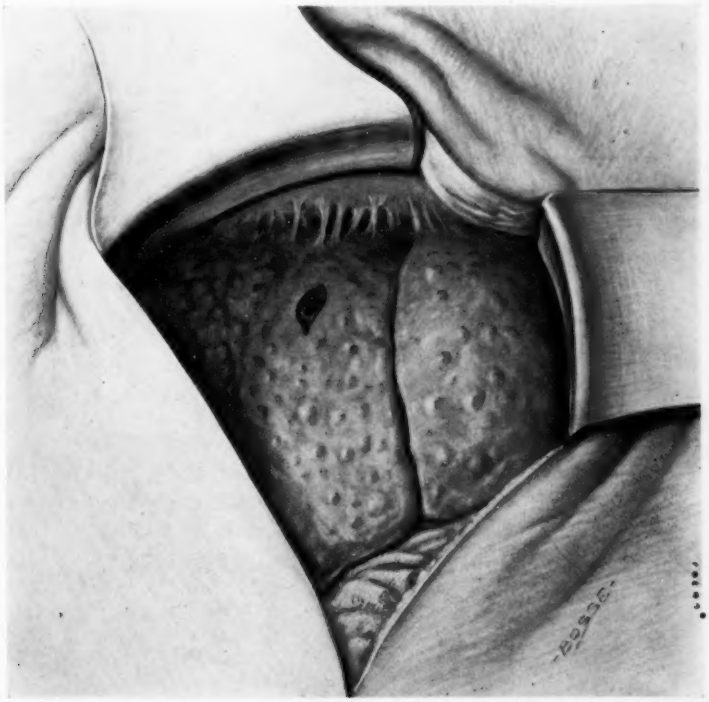

FIG. 2.—Removal of intrahepatic stones from diaphragmatic surface of the liver.

centimetres of a turbid fluid and one-half dozen yellowish gall-stones. The yellowish color of these gall-stones differed markedly from the black color of the intrahepatic stones. The mucosa was only slightly inflamed and not thickened. Rubber tube sutured into gall-bladder with plain gut.

Abdominal incision closed, through-and-through sutures of chromic gut being used, and a space left for the tube and gauze drains; skin closed with silk.

A careful examination of the bile ducts was not possible on account of the poor condition of the patient.

Post-operative Diagnosis.—Intrahepatic cholelithiasis; spon-

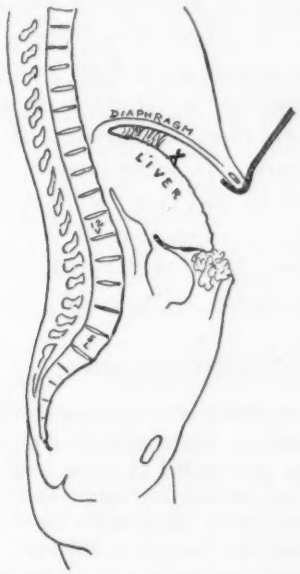

FIG. 3.—Diagrammatic side view. *X*, removal of intrahepatic stones from the diaphragmatic surface of the liver.

taneous perforation of intrahepatic stones at the under surface of the liver, causing a localized peritonitis.

The post-operative course during the first week was uneventful. From the seventh day a profuse biliary discharge set in. The stools were acholic. This complete biliary fistula lasted for about six weeks. Later the stools began to show normal color and the discharge from the biliary fistula was considerably less. The patient left the hospital on February 5, 1915. The biliary fistula persisted until September, 1915, and then closed spontaneously. For the last four months the patient has been apparently in perfect health and attends regularly to his business.

Dr. S. Bookman, Chief of the Department of Physiological

Chemistry, of Mount Sinai Hospital, was kind enough to examine the intrahepatic stones. He reported the following findings: Weight 2–3 mgm.; chemical construction: fatty acids, cholesterin (48.11 per cent.), and bile pigments. No phosphate, calcium or magnesium.

The high percentage of cholesterin in these stones is rather uncommon. Most of the intrahepatic stones reported in the literature consisted mainly of bilirubin-calcium.

The intrahepatic stones were black, very irregular in shape and non-facetted. The stones removed from the gall-bladder showed a light greenish color and had a smooth surface (typical facets).

The surgical literature of intrahepatic calculi is a very small one; it comprises only two cases (Hawkes and Noguchi). Noguchi removed a solitary stone from a patient thirty-four years of age, from the hilus of the liver. The stone had a diameter of one and one-half centimetres. Noguchi reports that the exposure of the operative field was by no means satisfactory. It seems to me very doubtful whether Noguchi's interpretation of this case (solitary intrahepatic stone) is a correct one. It is very possible, that he was dealing with a solitary stone in the cystic duct which had perforated into the surrounding tissue, where it became encapsulated. The gall-bladder was not removed in this case. .

Hawkes reports a very interesting case:

The patient had been operated on two years previously for cholelithiasis; a cholecystectomy had been done. The symptoms recurred and the X-ray showed some shadows; these were interpreted as being caused by several calculi. Exploratory laparotomy: Upon passing the hand upward toward the dome of the liver on the right side, a number of calculi were found imbedded in the liver substance about four inches from the free bed of the liver. The calculi were situated about one-quarter of an inch from the capsule of the liver in a mass of hardened tissue. It was thought wise not to remove these calculi at once on account of the danger from biliary leakage, there being no adhesions at this point. For the promotion of adhesions sterile gauze packings were introduced to the area occupied by the calculi. Four days later the calculi were removed by an incision through the liver substance. Three calculous masses were dug out with the index finger from the indurated tissues surrounding them. The stones numbered twelve, varying in size from $^1/_{16}$ to $^1/_8$ inch in diameter. The patient made an uneventful recovery.

Hawkes's patient undoubtedly was a case of removal of intrahepatic stones. The case, however, does not present quite as typical an appearance as my case reported above, and the typical cases of intrahepatic cholelithiasis found rather frequently in the dissecting room. There is no evidence that in Hawkes's case the stones were disseminated

through the whole biliary system of the liver. The surface of the liver (except for the one place where the conglomeration of stones was found) was smooth and there was no such evidence of an intrahepatic stone formation through the entire liver as in my case.

Beer has pointed out that three different etiological factors have to be considered for the formation of intrahepatic stones; first, obstruction; second, cholangeitis; and third, an unknown factor (diathesis?). Obstruction and cholangeitis alone cannot explain the picture of intrahepatic cholelithiasis. For intrahepatic stones are, as a rule, not found in complete obstruction of the common duct by a tumor at Vater's papilla, though a secondary cholangeitis is very often present in these cases. We must therefore assume a third factor which causes the formation of intrahepatic stones.

A vast literature has accumulated on the subject of the formation of gall-stones. It would, however, go far beyond the scope of this paper to review the innumerable publications on this subject. Frerichs, Thudichum and Courvoisier claimed that the stagnation of bile was the cause for the formation of intrahepatic stones. Naunyn claimed that bacteria wandering into the biliary system caused an oxidation of bile and secondary formation of gall-stones.

Mignot has made extensive experimental studies which seem to support Naunyn's views. He introduced cotton pledgets saturated with emulsions of attenuated cultures of bacterium coli into the gall-bladder and thus caused after five months the formation of stones. The introduction of aseptic foreign bodies into the gall-bladder did not produce any stones. Miyake arrived independently at the same conclusion.

The question of the formation of intrahepatic stones is of the greatest interest to the surgeon. Every surgeon will experience cases where, after a previous cholecystectomy and a thorough removal of common duct stones, he has to reoperate on account of jaundice. At the second operation, he again finds stones in the common duct. The question then arises: Were these stones overlooked at the first operation?

There can be no doubt that such findings are not necessarily due to a faulty technic. It is possible that intrahepatic stones, formed in the finer ramifications of the hepatic ducts, have wandered down into the common duct and have thus produced a recurrence of symptoms.

A great deal of discussion has been caused by the question whether intrahepatic stones are formed in the liver or whether they are formed in the gall-bladder and have later wandered upward into the liver. Beer has already pointed out that the intrahepatic stones differ entirely in shape, color and character from the stones found in the gall-bladder,

and that it is therefore impossible to assume that the intrahepatic stones had originally been formed in the gall-bladder. The findings in my case confirm this view. The stones removed from the hepatic ducts differ absolutely from those removed from the gall-bladder. Furthermore, in Lenhartz's case (Fig. 4), one of the most typical cases of intrahepatic cholelithiasis, the gall-bladder did not contain any stones. It is therefore beyond doubt, that intrahepatic stones can be and are formed in the liver.

The divergence between the rather frequent cases of intrahepatic cholelithiasis in the dissecting room and the rarity of this condition in clinical surgery can be explained by the fact that the condition is easily overlooked on the operating table. As a rule, the surgeon who finds stones in the gall-bladder is satisfied to remove the stones either by cholecystostomy or cholecystectomy. He does not inspect the liver very carefully and thus misses the proper diagnosis which requires a very thorough examination.

The interesting points which induced me to report this case are:

1. The extreme rarity of this condition in surgical pathology.

2. The fact that this is the first case in which intrahepatic stones had perforated, thus causing a localized peritonitis.

3. The interesting observation that a biliary fistula which persisted for eight months, closed spontaneously (and has remained closed for four months), though the hepatic ducts, and very probably the common duct, are filled with stones.

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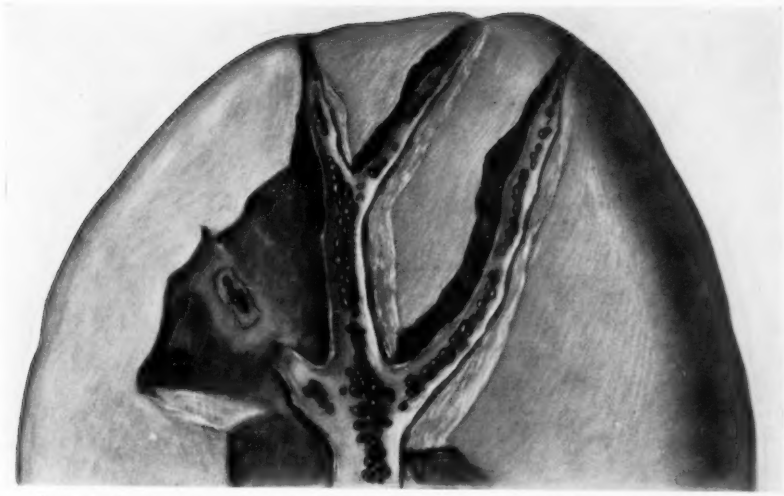

FIG. 4.—Post-mortem specimen illustrating intrahepatic cholelithiasis (Lenhartz).

A METHOD OF CORRECTING THE STOMACH DILATATION IN GASTROPTOSIS

By R. J. Behan, M.D.
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surgeon, st. joseph's hospital

In the correction of an enlarged and dilated stomach the aim heretofore has been to support the stomach in such a manner that its fundus is raised so that the greater curvature would be nearly on a level with the pylorus, and consequently permit of better drainage. The methods previously devised consisted of shortening the gastrohepatic ligament, of attaching the omentum to the anterior abdominal wall, or of attaching the stomach to the anterior abdominal wall by means of adhesions.

The surgical principle of all these methods seems to be wrong in

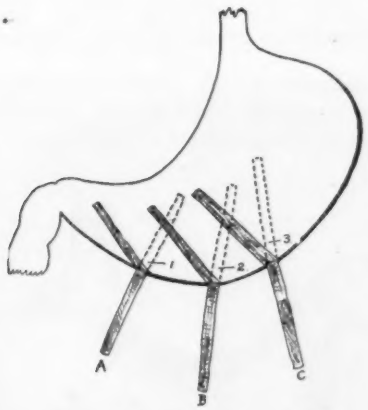


Fig. 1.—The method of making the flaps of serosa. The dotted lines indicate the direction of the tunnels and the manner in which they run under the serosa.

that the pathological state (the atony) causing the end lesion is not corrected; only the end lesion (the ptosis) itself is affected. Two of the end results of a gastroptosis are gastric dilatation and an abnormally low position of the stomach. Both of these act in a vicious circle, for because of the ptosis the pylorus is kinked and consequently food and drink entering the stomach will not easily be extruded, and will act as additional inciting factors to a further dilatation and ptosis.

The surgical corrective principle would be either to decrease the

size of the stomach or in some manner to render it functionally more active. The first of these is accomplished by the operation I have devised. The second will follow as a result of the first.

To test the harmlessness of decreasing the size of the stomach I performed an operation embodying these principles on a dog, and the results were remarkably good. The description of the method follows:

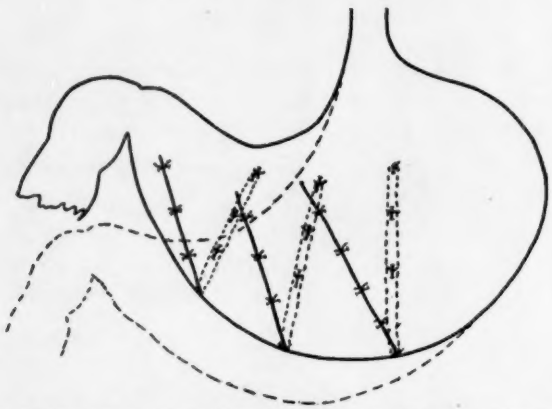


FIG. 2.—The flaps have been drawn through the tunnels. The sutures have been placed.

Dog Operation.—Abdomen opened. Stomach exposed and a flap of serosa was freed from its anterior surface. The flap (½ inch wide) extended from the lesser curvature downward obliquely toward the greater curvature and fundus

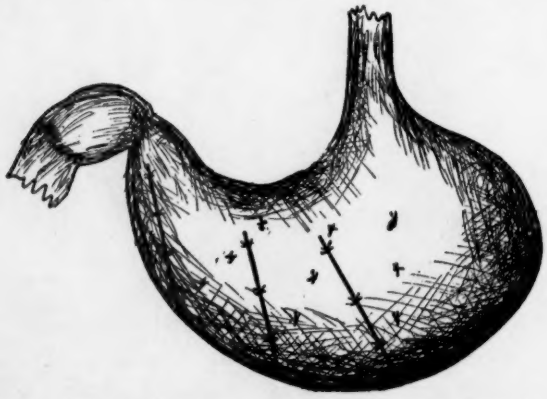


FIG. 3.—Operation has been completed. Figure does not show the plication in the gastrohepatic omentum, which is also necessary to bring the stomach up into its normal position.

for about 3 to 4 inches (Fig. 1.). This flap was then inserted in a reversed direction through two flaps raised from the subjacent muscularis (Fig. 2). The flap was then sutured in place. The raw surface was puckered in (Fig. 3) and the wound closed.

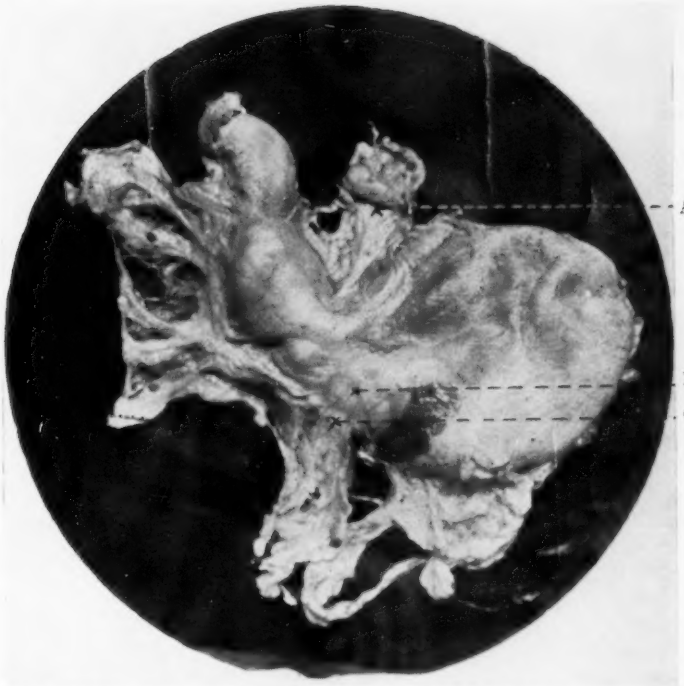


FIG. 4.—The stomach before it was opened. The scar is seen at *B*. At this place it is also to be noted that the omentum is drawn up to a considerable extent (about 1 inch) on the anterior surface (*C*), thus narrowing the lumen to the same degree. Adjacent to *A* is seen a raw area, to which, because of certain later operative procedures, the abdominal wall had been attached. The contractive power of the stomach must have been excellent, as even after death water is forced with difficulty through the pylorus. The gastrohepatic omentum is plicated at the point *A*.

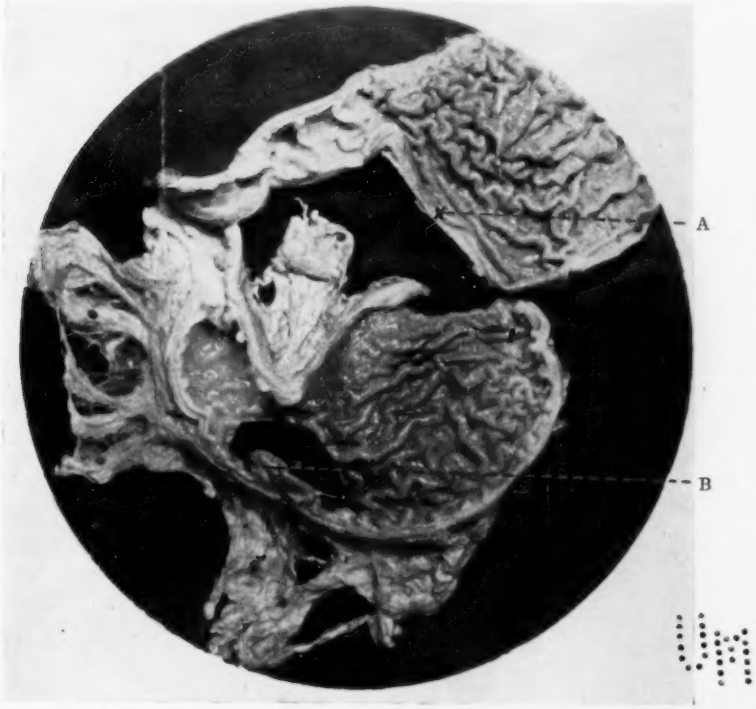


FIG. 5.—The lumen of the stomach with its rugæ is exposed. The large ruga (*B*) anterior to the black paper on the greater curvature is due to the redundance of mucous membrane due to the contraction of the wall. At *A* is seen the thickened wall consisting of the muscularis. The rugæ seem to be absolutely normal in appearance.

February 21: The dog was very active and frisky, extremely playful. Incision O. K.

March 23: Abdominal incision. The area of stomach operated showed a scar somewhat T-shaped. No adhesions. Stomach much smaller than at time of first operation. At the time of the first operation the lower border of the greater curvature extended a considerable distance below the liver margin. At the present the lower border extends only a very short distance below it.

On December 12, 1915, the dog was killed, and the stomach removed. It was remarkably decreased in size. On the anterior surface is seen the scar resulting from the operation. On examining the internal surface of the stomach the rugæ are apparently not disturbed over the area operated. On examining the wall it is seen that at the area of operation there is a very long ruga which projects into the lumen of the stomach. The wall is greatly thickened.

The specimen shows that after the plication the muscle contracted and threw the mucosa into deeper folds. Thus the same area of mucous surface is exposed so that the food comes into direct contact with the same extent of mucous membrane. To sight and touch the gastric muscle is absolutely normal.

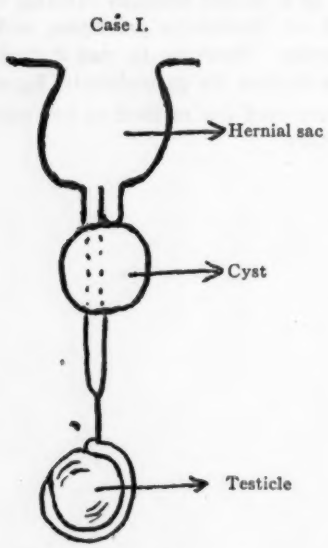
Whether this method would act as well in a dilated stomach remains to be proven. It is not dangerous. It is planned on physiologic principles, and the stomach functionates perfectly after its adoption. However, in man it might be necessary at the same time to plicate and thus shorten the gastrohepatic ligament.

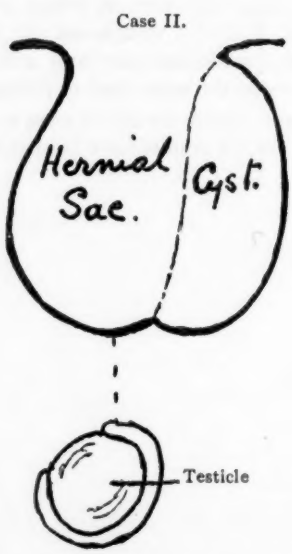
NOTE.—Since the above went to press I have used this method on two patients and so far the results have been very satisfactory.

THE ETIOLOGY OF CYSTS CONNECTED WITH HERNIAL SACS

By R. W. Murray, F.R.C.S.
of Liverpool, England

Any surgeon who has had occasion to perform a large number of operations for the radical cure of inguinal hernia must, from time to time, have met with anomalous conditions of the sac and its connections which are difficult to account for satisfactorily. This has been my experience, and I will exemplify my meaning by referring to two cases, and at the same time venture to offer an explanation of the state of affairs found at the operation.





In one case the patient was a young man suffering with a "hydrocele of the cord." At the operation a small hernial sac was found, and connected with the fundus of the sac was the peculiar and complicated condition depicted in the accompanying diagram.

Attached to the fundus of the sac were two patent funicular processes, each of which opened into the sac. At the blind end of the shorter process was a tense cyst, one inch in length, which contained clear fluid. The longer process had a uniform lumen and passed downward behind the cyst, to which it was intimately adherent. The lower end of this process was connected with the

tunica vaginalis by a fibrous cord, so that it was undoubtedly the remains of the true processus vaginalis testis.

The other case was that of an adult male who was admitted to hospital for the cure of a scrotal hernia which had existed for many years and could not be reduced satisfactorily. At the operation a large cyst, which contained clear fluid, was found lying upon and intimately adherent to the anterior surface of the sac wall. The relative size and relation of the cyst to the hernial sac are illustrated here.

Though the origin of these two cysts may at first sight appear to have nothing in common and be difficult to account for, their presence can, I believe, be readily explained on the views advanced many years ago by Mr. Lockwood regarding the etiology of infantile hernia. Mr. Lockwood pointed out that if the processus vaginalis is drawn down by the gubernaculum, a second sac of peritoneum might be produced by the traction of some additional fibres of the gubernaculum in a manner entirely analogous to that which produced the processus vaginalis testis.

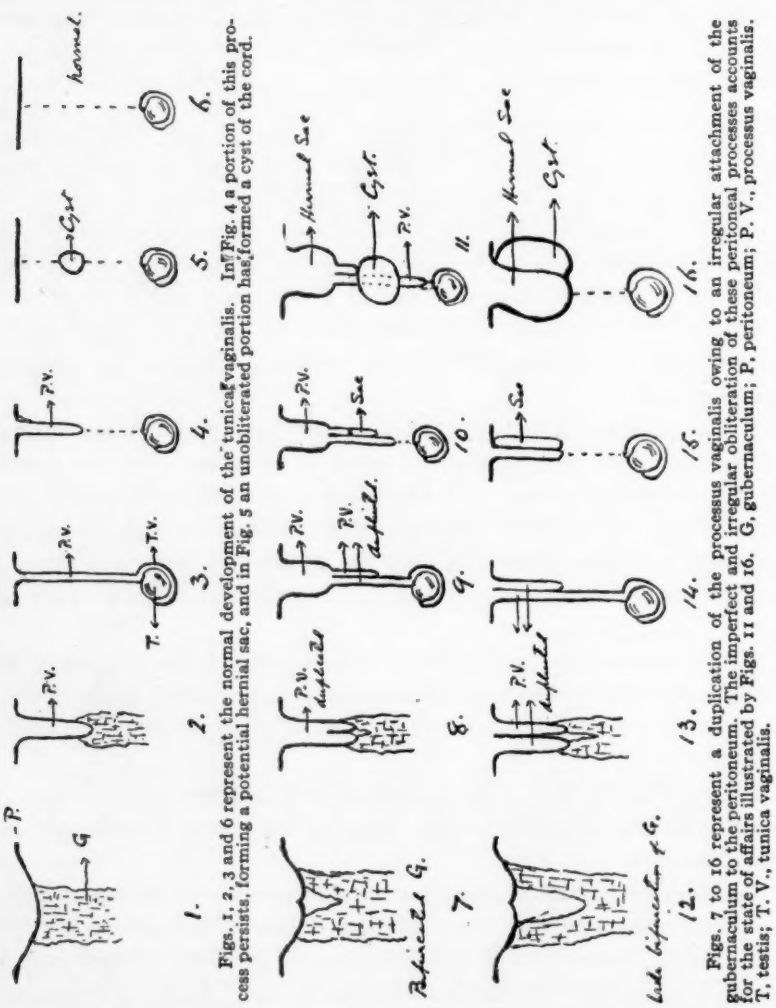
It is a well-known fact that the obliteration of the processus vaginalis is frequently imperfect and often takes place in an irregular manner. The most common defect is for the upper part of this process to remain patent, thus forming a potential hernial sac. The whole of the funicular process may remain patent, or only the upper and lower ends may become obliterated, thus resulting in a cystic distention of the unobliterated part.

Many other irregularities have been observed, but I merely wish to emphasize the fact that obliteration may fail to occur at any point in the whole length of the process from the tunica vaginalis to the internal abdominal ring.

In the Figs. 1 to 6 I have represented diagrammatically how the tunica vaginalis is formed, and some of the more common developmental defects.

Bearing these facts in mind let us see how the anomalous condition found in the two cases I have mentioned can be accounted for. The chief difficulty in the first case is to explain the presence of two funicular processes attached to the fundus of a hernia sac. As the gubernaculum is responsible for the normal descent of a process of peritoneum to the bottom of the scrotum, it is reasonable to suppose, as Mr. Lockwood was the first to suggest, that if this process is duplicated the gubernaculum must have something to do with it, for there is no other structure that could perform a similar function.

In the first case the peritoneal attachment of the gubernaculum must have been bifurcated, and consequently two peritoneal processes instead of a single one were pulled through the inguinal canal toward the scrotum (Figs. 7 and 8). It should be noticed that the duplication of the funicular process is not complete, for the division does not extend



Figs. 1, 2, 3 and 6 represent the normal development of the tunica vaginalis. In Fig. 4 a portion of this process persists, forming a potential hernial sac, and in Fig. 5 an unobliterated portion has formed a cyst of the cord.

Figs. 7 to 16 represent a duplication of the processus vaginalis owing to an irregular attachment of the gubernaculum to the peritoneum. The imperfect and irregular obliteration of these peritoneal processes accounts for the state of affairs illustrated by Figs. 11 and 16. G, gubernaculum; P, peritoneum; P. V., processus vaginalis. T, testis; T. V., tunica vaginalis.

up to the level of the internal abdominal ring. As the duplication is not complete it is probable that the peritoneal attachments of the gubernaculum were not widely separated, and its contraction caused the funicular process to have two nipple-like terminations. The subsequent changes are not difficult to account for, and are depicted in Figs.

9 and 11. The longer process, after forming the tunica vaginalis, became obliterated at its lower part, the upper part remaining patent. The shorter process became obliterated about its middle, thus forming a closed sac below, and remained patent above (Fig. 10). The bowel descended into the large single diverticulum into which both these processes opened, thus conevrting it into a hernial sac; and fluid accumulating in the small closed sac, a cyst was formed.

In the second case I believe the developmental irregularities were very similar to those I have just described. In this case, however, the duplication of the processus vaginalis must have been more complete, extending up to the level of the internal abdominal ring. This I would account for by a wider bifurcation of the peritoneal attachment of the gubernaculum than in the other case, consequently two complete and separate processes of peritoneum were drawn through the inguinal canals (Figs. 12 and 13). The lower half of the longer process—the true processus vaginalis testis—became obliterated after forming the tunica vaginalis, the upper half remaining patent. The upper part of the shorter process became obliterated, thus forming a closed sac (Figs. 14 and 15). Bowel entering the patent diverticulum converted it into a hernial sac; and fluid accumulating in the closed sac made it a cyst. All these changes are represented diagrammatically in the accompanying figures.

In conclusion, I would submit that as the gubernaculum is undoubtedly responsible for the presence of the peritoneal diverticulum known as the processus vaginalis testis, circumstantial evidence is strongly in favor of the view that if this process is found to be duplicated, then this second diverticulum must be due to a duplication of the force which produced the first. If this premise is correct, then the subsequent irregular obliteration of these processes clearly accounts for the anomalous conditions I have described.

LUMBAR HERNIA *

By Edward H. Goodman, M.D.
and
John Speese, M.D.
of Philadelphia

Hernia in the lumbar region is one of the rare varieties and may occur as a congenital affection, as a spontaneous or acquired form, or as the result of severe local injuries or diminished local resistance following infectious processes. In reporting an instance of spontaneous or acquired hernia, we have thought it desirable to review the literature on the subject, as there is considerable uncertainty as to what constitutes a true lumbar hernia. We have studied, therefore, the instances of congenital and acquired hernia and have excluded from our statistics those hernias following direct traumatism of any type, and those the result of local inflammatory processes, both of which have been instrumental in causing a fairly large number of the cases on record. We have found reports of 33 cases of acquired lumbar hernia, 11 of congenital lumbar hernia, and about 40 cases following local injury and disease.

The entire subject of lumbar hernia is attended with much interest from the historical stand-point. We have consulted Jeannel's article freely for the descriptions of the cases reported by the first writers on this subject.

In Pierre Franco's *Traité des Hernies*, published in 1561, nothing is said of hernia other than inguinal, and it is not until a century later (1672 or 1687) that we find what seems to be the first description of lumbar hernia. Paul Barbette at this time states that, "Experience has taught me that the peritoneum may rupture in its posterior aspect toward the back, thus forming a hernia." Stephen Blancard, in 1701, states only, "Peritoneum prope spinam dorsi ruptum dat herniam"; a laconism which suggests the possibility of a lumbar hernia but does not permit of the supposition that the author had seen a case.

Dolée (1703) knew of lumbar hernia, but he, like his predecessors, took no pains to study its anatomy or its mechanism, although later writers without quoting Dolée correctly have interpreted him as describing lumbar hernia. Jeannel emphatically states that there occurs no passage in Dolée's writings to warrant this, and he reproduces verbatim the Latin text, which is without any special interest. Budgeon, in 1728,

* Read before the Philadelphia Academy of Surgery, December 6, 1915.

described a case of congenital hernia, but it is apparent that he had no idea of the true nature of the condition.

The first trustworthy observation on record is that of Garangeot (1731), who mentions a case of strangulated hernia, reducible after death, perhaps at the expense of a ruptured intestine. Although Garangeot made no autopsy, there can be little doubt about the true nature of the case. The report made by Garangeot failed to stimulate the interest of his contemporaries, for Arnaud (1749), although knowing that hernias may present themselves in the back, forbears to say more, as such hernias, " far from instructing those for whom I write, may prevent one from comprehending ordinary hernias." *" Étrange prétexte ou plutôt mauvaise excuse de l'ignorance de l'auteur,"* is the comment of Jeannel.

Ravaton, in 1750, published the first case of strangulated lumbar hernia which was cured by operation, but details are lacking as to the exact location of the tumor. A decade later Hermann (1767) described a case of strangulated hernia which was cured spontaneously by the formation of an artificial anus. In 1768, Balin writes, " Lumbar hernia may arise unexpectedly between the false ribs and the crest of the ilium, at the point where the external oblique is attached only by a cellular tissue." Although this is brief, terribly laconic, according to Jeannel, the latter claims that Petit, to whom is given the credit for describing the triangle which bears his name, has written no more fully. Jeannel discredits Petit (1774), and claims that in his article he has not described the triangle in question, has not furnished us with any anatomical data concerning his case, and Jeannel confesses he is at a loss to know why this region is called " Petit's triangle " any more than by the name of Dolée, Garangeot, Ravaton or Balin, who wrote as fully about it as did Petit. This view, it may be mentioned, is shared by Larrey also.

Since Petit's time no one until the advent of Grynfeltt attempted any serious study on the subject, and the term lumbar hernia was used so loosely that ventral hernias were continually being confused with the lumbar variety (Plenck, Chopart and Desault, Callison).

Grynfeltt (1866) was the first to give the subject deep thought, and described the space which bears his name. " The aponeurotic fibres of the transversalis in dividing form a passage for the lower intercostal artery, just as the spermatic cord enters the two pillars of the external ring. There is at this site a natural point of lessened resistance. If the lower border of the internal oblique inclines more anteriorly than normally, the last intercostal artery perforates the aponeurosis of the transversalis above the border. In other words, if the point of re-

sistance of this artery is in the lumbo-costo-abdominal triangle all the conditions favoring a hernia are realized." The space of Grynfeltt is bounded above by the twelfth rib, internally by the quadratus lumborum, externally by the external oblique and below by the internal oblique muscle.

Four years later Lesshaft (1870), without mentioning Grynfeltt's work, came to the same conclusions and the space is known in Germany as Lesshaft's triangle, but its proper name should be the Grynfeltt-Lesshaft space. Lesshaft studied 108 adult cadavers, and found Petit's triangle present in 84. In 34 cadavers of embryos or new-born the structure was present 9 times. In other words, the triangle is generally present in adults and only occasionally in embryos or the new-born. When the triangle was not present it was noted that the edge of the latissimus dorsi muscle was in direct apposition with or overlapped the margin of the external oblique. The importance of the triangle was emphasized by these studies, as it is more constantly present and is larger than the inferior triangle of Petit.

V. Baracz and Bursynski have in turn made anatomical studies with the following results: After the first layer of the back muscles is turned aside (latissimus dorsi) one sees the second layer, consisting of the posterior inferior serratus muscle and the internal oblique. Between these two may be seen the third layer, the aponeurotic portion of the transversalis. This muscle with the lower border of the serratus posticus inferior, together with the inner edge of the twelfth rib above, the erector spinalis, the internal oblique and the external oblique laterally, and the base composed of the transversalis, make up the triangle lumbo-costo-abdominal of Grynfeltt and Lesshaft.

The authors have made numerous dissections, having reference to Petit's triangle and to the triangle of Grynfeltt, and of 76 examinations, Petit's triangle was missing 12 times on both sides and 4 times on one side only. It existed, then, in 63.13 per cent. of the cases. The size of the triangle varies a great deal, often merely a slit and again having a base 5 or 6 cm. wide. The base may be muscle alone (internal oblique) or muscle and tendon where the internal oblique extends to the lateral base of the erector spinalis. To pierce this layer great force was necessary, and as there are no openings for the vessels or nerves, the authors consider it improbable that a hernia can rise through Petit's triangle.

The Grynfeltt-Lesshaft triangle was present in 93.5 per cent. of the dissections, and the authors regard it as an almost constantly occurring weakness in the lumbar region. The space is not always that of a triangle or rhombus, it may be deltoid, trapezoid or polyhedral. The

shape and size of the triangle depend on several factors: the length of the twelfth rib, whether the internal oblique with its muscle bundles reaches to the lateral border of the erector spinæ, or is in varying distance therefrom forming a tendinous aponeurosis; upon the development of the serratus posticus inferior; upon whether the fibres of the median border of the external oblique insert on the tip of the twelfth rib or above or below the rib; upon the existence of a tendinous arc in the aponeurosis of the transversalis muscle; furthermore, upon whether the median portion of the latissimus dorsi inserts in the eleventh or twelfth ribs or whether it unites with the posterior fibres of the external oblique, and finally the size and shape depend on the development of the quadratus lumborum.

The most common form is an acute angled quadrilateral, or a triangle. The thickness of the aponeurosis varies in this space but at the uppermost limit the thinnest portion of the lumbar region is seen. In this thin area vessels and nerves are found, usually the twelfth intercostal, and it is in this region that hernias most often occur.

Etiology.—In the etiology of the cases quoted in this paper, indirect traumatism alone is accepted as a cause, and all the cases are excluded in which the hernia followed direct injury, or was secondary to infectious processes, sinus formation, or visceral protrusions due to muscle paralysis. By indirect traumatism is meant conditions demanding habitual or sudden strain, lifting of heavy weights, coughing, and the strain following falls. In 14 of 33 cases, such a history is mentioned, the hernia appearing soon after the injury was sustained. Whether there has been a congenital predisposition in these cases is a matter of debate; there is little evidence to support such a view. It must be mentioned, however, that emaciation, old age, repeated pregnancies, by lowering muscle tone, predispose to the development of lumbar hernia. In those cases in which the age is given we find but 5 instances occurring before the fortieth year of life, 4 in each of the three succeeding decades, and in quite a large number of cases, the histories state that the hernia occurred in an elderly person.

There is a marked predisposition toward the development of hernia on the left side, 19 cases being noted here, 10 on the right side and 2 were bilateral. The hernias occurred 22 times in males and 9 times in females.

The hernia is generally subcutaneous but may be separated from the skin by a layer of fat or muscle. There is considerable doubt concerning the formation of a sac, for it has been distinctly noted at operation and at postmortem that a sac composed of peritoneum often is lacking. This

seems to be particularly the case in the hernias composed of fat protruding from the subperitoneal or perinephritic tissues.

The hernia is composed of fat, mesentery, large or small intestine or, in rare instances, the kidney, and as a rule the hernia is reducible without difficulty, even when symptoms of strangulation have developed. As to the site of the orifice it is impossible to determine this with accuracy in most cases unless an operation has been performed. Jeannel claims that hernias due to effort or to trophic changes in the muscles present themselves in Petit's triangle or in the Grynfeltt-Lesshaft space, while traumatic hernias and those due to disease may occur anywhere. In many cases the site of the hernia is distinctly stated, and where accurately described we have found that 6 cases occurred in the Grynfeltt-Lesshaft space and 9 in Petit's triangle. When all the cases are grouped together one triangle is involved about as frequently as the other.

The symptoms depend largely on the cause of the hernia. In our case the onset was insidious, the hernia entirely escaped the patient's notice until it was pointed out to him twenty years after the first symptom following strain. During these years he was convinced that the only inconvenience he experienced was a feeling of weariness in his back after a day of hard work. In this case as in a typical example of any type of hernia, the signs characteristic of a hernia were so well marked that there could be no question of the correct diagnosis. It should be mentioned, however, that errors in diagnosis have been made, and hernias have been incised in the belief that the condition was an abscess. In one instance the bowel was opened and a fecal fistula resulted.

Most authors speak of the serious nature of lumbar hernia because of the tendency toward strangulation. Jeannel in his analysis found strangulation in 18 per cent. of the cases; this collection including hernias due to all causes. In the 33 cases of spontaneous hernia we have collected, symptoms of intestinal obstruction or strangulation, either mild or severe, were mentioned 8 times, or 24 per cent. In many, the symptoms were mild and disappeared when the hernia was reduced. Reduction was accomplished easily, even when the symptoms indicated a severe form of strangulation, a feature probably due to the absence of a sac, removing the danger of constriction exerted at its neck.

Operative measures have been uniformly successful in the treatment of lumbar hernia, although the number of operations reported is comparatively small. Despite the fact that symptoms of strangulation are so frequently encountered, but one operative death is recorded. In

FIG. 1.—Lumbar hernia.

many instances comfort is secured by the use of a truss or belt and the hernia is thus retained within the abdominal cavity with a considerable degree of comfort. As so many of the patients are advanced in years, and in a debilitated condition, operation should be advocated with some degree of caution. Of course a radical cure should be undertaken when symptoms of strangulation arise, or when the general condition of the patient becomes a matter of concern from the pain and inconvenience of the hernia.

Patient, John C., aged fifty-eight, was admitted to the medical wards of the Presbyterian Hospital, service of Dr. James E. Talley, October, 1915, on account of nephritis. On examination of the patient, a swelling in the left lumbar region was noted. The patient said that until our discovery of this tumor he had been unaware of its existence. Just how long it had been present it is impossible to state, but the following history obtained from the patient leads us to suppose that it must have existed for many years.

The patient is a stone mason by occupation and is accustomed to very hard work. About eighteen or twenty years ago, while attempting to lift an unusually heavy piece of stone, he was seized with a sharp pain in the left side of his back, which persisted for about a week and which prevented him from working. He does not know if any swelling appeared at that time, and, as we have stated, has been unaware of any tumor existing in his side, until this autumn. This pain he was told was due to a strain, and since then he has often had attacks of " weak back," particularly when his work was unusually heavy. At times when he has attempted to lift a weight he has felt something tighten in his back, as if something were pinching him, but this sensation would pass off on assuming the upright position, and after resting a few minutes. He has never had any signs of strangulation, nor has there been any permanent interference with his work on account of his back.

Examination reveals the presence of a tumor in the left lumbar region just under the last rib. The tumor is about 3 cm. in diameter, is rounded and painless. On palpation the swelling is soft and may be easily reduced with gurgling, gives an impulse on coughing which makes the swelling more prominent as does any straining effort. On percussion the tumor is resonant and ascultation reveals peristaltic sounds. When the patient bends forward, the tumor becomes more prominent; when he lies on his abdomen, the tumor disappears spontaneously, and there may be felt a small opening in the dorsal muscles admitting the tip of the middle finger, against which is felt an impulse when the patient coughs. These

findings at once led to the certain diagnosis of lumbar hernia, presumably in the Grynfeltt-Lesshaft space, not in Petit's triangle.

We were interested in learning just what part of the intestine formed the hernia, and as far as we are able to decide by means of the X-ray, it is the small intestine which protrudes. Although recognizing that strangulation occurs in a larger proportion of cases than in inguinal hernia we advised against operation on account of the patient's age, the renal condition (nephritis) and on account of the benignity of the hernia, no symptoms developing during the eighteen or twenty years of its existence.

The accompanying photograph shows fairly well the site and the appearance of the hernia.

CONGENITAL LUMBAR HERNIA

Etiology.—The etiology of this form of hernia is unknown, unless it be due to congenital malformation.

For our knowledge of the anatomy we are dependent on the cases of Jeannel and of Coley, and it would seem that the sac is composed sometimes of parietal peritoneum itself, sometimes by the parietal peritoneum and large intestine, the descending colon when on the left side, the ascending colon when on the right. The sac is never adherent to the skin as far as is known.

The contents of the hernial sac may consist of any of the following—large bowel, small intestine, kidney. The site of the hernia may be either in the so-called triangle of Petit or in the space described by Grynfeltt, or in an anatomic region imperfectly described, along the external oblique at the level of the twelfth rib. As to the pathogenicity of this hernia, it may be said that the rupture falls in two categories, the one in which there has been a malformation, and the other not due to a malformation, but more in the nature of a paretic state of the muscles of the lumbar region.

From the diagnostic stand-point the recognition of a hernia should be easy, though there is a case on record in which the intestine was cut, under the impression that the swelling was an abscess (Dolbeau). It would seem that such a mistake should be impossible, as with a little care the diagnosis should be easily made.

Congenital lumbar hernia is an incurable infirmity. The course of the trouble is uncertain; there may be increasing discomfort or there may be progressive improvement with a support. There has been no record of strangulation having occurred, but one should always have before him the possibility of this accident.

Congenital lumbar hernia as well as the spontaneous type is never

cured by means of a bandage or truss, and it would seem that operative measures are to be urged.

CASES OF CONGENITAL LUMBAR HERNIA

CASE I.—Budgeon, 1728. Much contested and much discussed case. Tumor at birth, ruptured at seventeen years of age. Thought by some to have been lumbar hernia, by others, spina bifida, and by Jeannel to have been hydronephrosis.

CASE II.—Plenck, 1774. Hernia of kidney and not of bowel.

CASE III.—Monro, 1811. Hernia of kidney.

CASE IV.—Colles, 1829. Three years old. Tumor observed at time of birth. Tumor now size of a moderate-sized watch, at birth much smaller. Situated posteriorly immediately above skin of ilium, left side. Easily reducible.

CASE V.—Macready: "In 1882, a youth, aged sixteen, presented himself at the Truss Society, and has often been seen since then up to the present time (1890). Soon after birth a swelling was observed on the right side, for which a belt was worn during six months. The lump then disappeared, but was again noticed when he began his apprenticeship as a plate worker, some months before his appearance at the Society. He then had a hernia of the size of half an orange; it was easily reducible, and escaped by an opening immediately below and anterior to the tip of the twelfth rib."

CASE VI.—Mastin, 1890. Male. When six years of age, hernia measured eight and a half by nine inches, contents of sac were small bowel and descending colon. Apparent defect of latissimus dorsi and quadratus.

CASE VII.—Wyss, 1892. Boy, nine months old. Many other congenital defects. Right sided hernia through Grynfeltt's triangle.

CASES VIII and IX.—Berger, 1895. Simply says he has seen two cases, one in a sclerotic, the other in a little child, probably due to congenital defect of the muscles in the lumbar region.

CASE X.—Coley, 1895. Eleven months old child, with a hernia protrusion about the size of a goose egg in the left lumbar region. Noticed since birth and was probably due to a congenital malformation of the abdominal parietes, allowing this mass to protrude through the triangular space between the latissimus dorsi.

CASE XI.—Russell, 1898. Child. Doubt whether congenital or due to congenital absence of a portion of abdominal wall. Hernia is visible except when muscles were stretched. Was inclined to treat by transplant of muscle.

CASE XII.—Jeannel, 1902. Boy, four months old. Shortly after birth, tumor in right flank, size of hen's egg, situated between last rib and iliac crest. Tympanitic on percussion, reducible, increased by exertion, decreased by rest. Operation. Cure.

ABSTRACT OF CASES OF SPONTANEOUS LUMBAR HERNIA

1. RAVATON: Female, age not given, tumor of three weeks' duration, situated in the left lumbar region. Symptoms of strangulation developed. Operation. Cure.

2. PETIT: Patient was an adult female, hernia on left side in Petit's triangle, size of a child's head. Strangulation relieved by taxis. Recovery.

3. MONRO: Bilateral hernia in a child six months old, covered by skin only, immediately under the false rib. Each tumor contained kidney, easily reduced through an oval ring of a considerable size.

4. CLOQUET: Male, aged seventy-five, pain in lumbar region following strain; pain disappeared; recurred in two months with an attack of nausea and vomiting. Round tumor found in right lumbar region, 1 cm. from last rib. Tumor painful on palpation, gurgling, impulse on coughing. Symptoms relieved after reduction. Application of a truss gave considerable relief.

5. KINGDON: Male, aged fifty-four, for several years had asthma and cough. Eight days before he tried to lift a fire engine which he was cleaning and felt something give way in his back. At night when he undressed a swelling was felt which grew larger as he coughed. The hernia was the size of a fist and was situated between the lower ribs and the iliac crest on the left side. It was reducible, and the hole through which it came was small and above the iliac crest, about three inches from the spine at Petit's triangle. It felt crepitant, not gurgling, on reduction. The integuments over it were thin. On exhibiting the patient it was generally and unhesitatingly admitted that the swelling was a hernia through the foramen of Petit. (Quoted by Macready.)

6. BASSET: Young man with a swelling in the left lumbar region, size of an apple and ovoid in shape; had had this tumor since childhood. It was soft, elastic without fluctuation and resembled a lipoma. Coughing increased the size, gave impulse, expansible in character, reducible. There was a family predisposition to hernia in this case.

7. HARDY: Woman, thirty years old, admitted to the hospital for syphilitic paraplegia. While straining at stool noticed a tumor eight centimetres in diameter, just above the iliac bone, subcutaneous, large base, hemispherical, about the size of a fist, soft, no change in color of skin, no fluctuation, resonant on percussion. Reducible with gurgling, reappears on coughing and on effort, impulse. Patient perfectly well.

8. MARQUEZ: Old woman; while attempting to lift a heavy load of grass, felt a sudden pain in the side, becoming more and more painful and being accompanied by nausea, colic and extreme anxiety. Swelling in left flank, tender, gurgling, and spontaneously reduced. This hernia had been present five or six years.

9. TRIPONEL: In the discussion of Marquez's paper, Triponel said he was reminded of a strangulated right-sided lumbar hernia; operation. A year later another strangulation and a new reduction. Patient advised to wear a truss and to avoid violent muscular effort.

10. LEVY: Old country woman, swelling in left flank at side of Petit's triangle. Never had any serious inconvenience. Patient thought the tumor gave her lumbago on that side.

11. TURENNE: Case of elderly male with tumor in left flank of three years' standing, and arising without any apparent cause. It was the size of a nut, uneven, and rounded, and seemed to consist of a portion of the omentum. It was reduced easily, was kept in place by means of a bandage. It had never caused any inconvenience.

12. DOLBEAU: Old woman, no mention of the side. Opened for abscess. Recovery.

13. APPERSON: Female, aged sixty-three, tumor on right side, size of a teacup, now and then presented signs of strangulation but was easily reduced and retained by bandage and compress. Woman feeble and relaxed as the result of child-bearing.

14. COZE: Male, no ascribable cause. Hernia right side, toward the top of

Petit's triangle, size of a hen's egg; soft, reducible. Few months later patient, a soldier, being no longer able to keep up his occupation, was brought to hospital. At this time a large hemispherical tumor 12 to 14 cm. in diameter was noted, soft, no skin changes, readily reducible with gurgling, contents probably ascending colon.

15. COZE: Soldier, right side, toward top of Petit's triangle, 6 by 4 cm. in extent; reducible small tumor; gurgling. Previously operated on for this swelling, scar of operation on skin. The following month tumor had enlarged, was reducible, impulse, no gurgling.

16. GOSSELIN: Male, aged fifty-five. When fifteen years old had lateral curvature of spine, to the right. Since five or six months some pain in left renal region, colicky in character. When he coughs or exerts himself, side pains him, obliged to stop and press it with his hand. In the left lumbar region a hernia, the size of a mandarin; reducible.

17. MACREADY: A man aged fifty-four came to the Truss Society in 1884 with a swelling over the left triangle of Petit, about the size of a walnut. It increased somewhat on coughing, but was not reducible, and therefore, as this aperture could not be examined, some doubt exists whether the tumor was a hernia or a lipoma. He had also a left inguinal hernia.

18. MACREADY: A man aged thirty came to the Truss Society in 1889, who stated that usually after a hard day's work he had pain in the right side in the position of Petit's triangle. An impulse and a bulge on cough were found there, but no complete protrusion.

19. HUTCHINSON described an autopsy on an elderly emaciated man with a hernia the size of a fist, in the left lumbar region, extending from the last rib to crest of ilium; several years in duration; diminished on pressure, resonant on percussion, impulse on coughing, gurgling; no pain, no inconvenience. Thought it was in Petit's triangle, but on dissection found an opening above and to the inner side of Petit's triangle, was outside of the quadratus lumborum, through the transversalis and the latissimus dorsi. No sac of peritoneum found, but one formed from local hypertrophy of subperitoneal fat.

20. HUME: Male, aged sixty-eight, tumor in the left lumbar region for fifteen years, size of a fist, but became larger at intervals, when it was painful and symptoms of intestinal obstruction developed. When admitted for treatment, symptoms of strangulation had been present for two days, operation disclosed gangrenous small intestine caused by pressure of two fibrous bands, and a twisted sigmoid. Hernia did not seem to be in Petit's triangle. Death in twenty-four hours.

21. RUPPANER: Male, aged forty-eight, history of strain and fall followed by pain in left lumbar region. Operation eleven days after injury disclosed a rent in lumbocostal fascia, 1 cm. in length, through which protruded a nodule of fat, size of a cherry. No sac present, tumor reduced, rent and muscles sutured. Hernia was in trigonum lumbale superior.

22. STARR: Male, age not given; eighteen years ago fell while carrying a sack of grain on shoulder, and hurt his side. He thinks lump did not appear at that time. Twelve months ago while stooping down preparing to lift a weight he was seized with pain in the side, which for a few minutes prevented him from assuming the erect position. After the severe pain had ceased, he noticed a lump in his back which has persisted ever since, always a steady pain in the side,

which sometimes becomes sharp and shoots into the backbone. The swelling is about the size of a duck's egg, its long axis being directed from above, downward and outward, and is situated in the right lumbar region, between the lower border of the ribs and the crest of the ilium. Slightly tender on pressure, elastic, reducible; crackling sensation on reduction, on straining tumor gives tympanitic note.

23. GALLOWAY: Male, after being in the army for four years, developed hernia which was the size of a partridge's egg, and has gradually grown to present dimensions, five inches in length by two inches in width, left side.

24. DUMESNIL AND BRUMON: Male, sixty-one years old, complained of shortness of breath and sometimes dyspnœa. During the examination, patient strained and immediately there appeared a tumor in left lumbar region. He says he noticed this fourteen years before. At this time it was about the size of a walnut and painless. In 1891, it was the size of a mandarin orange, but had not increased in size since then. When the patient rested, no tumor, but on exertion it became quite large. It is painless, gurgling and reducible. Never prevented patient from pursuing his occupation as collier. Since 1885 a bandage has sufficed to hold the tumor in position.

25. ZENTNER: Female, aged six years; following whooping cough, developed a walnut-sized tumor in the left lumbar region, also history of violent strain in falling, followed by pain the same day and tumor a few days later. Bandage applied but tumor enlarged in spite of constant pressure. Now tumor is size of hen's egg, is soft, tympanitic and is reduced easily, no gurgle. Situated in Lesshaft's triangle. Operation disclosed sac of peritoneum projecting through transversalis, omentum in sac, sac and muscle sutured. Cured.

26. DEMOULIN: Male, forty-seven years old, mason, who, as a result of a violent effort six months before, felt a severe pain in the lumbar region, followed by an egg-sized tumor. No serious accident has resulted from tumor. Diagnosed lipoma, not completely reducible. This was a hernia developing from the fat capsule of the kidney.

27. JONES: Male, aged forty-five; tumor present for four or five years, lately producing local pain and tenderness, constipation and dyspnœa. Hernia on right side, extended from the ribs to iliac crest; reducible with gurgle; impulse on coughing. Operation. Fat found in hernia; no sac, cure.

28. BARACZ: Male, aged thirteen. Tumor left-sided, below twelfth rib, size of a billiard ball, also small one in left flank. Straining causes prominence, tympany over hernia, reducible, in Grynfeltt's triangle.

29. GAILLAC: Soldier jumped from height; immediately felt severe pain in the lumbar region and swelling—egg-sized tumor, soft, painful, reducible.

30. LEJARS: A man sixty-five years old developed symptoms of strangulation in left lumbar region; large tumor, painful, reducible. Patient stated that he had had it twenty-five years and during this time it was the size of a walnut. In the first three weeks it had been growing in size, painful and colicky. During the last six days obstinate constipation; for past three days not even gas came from the rectum; extreme nausea, distention of abdomen, and pain, particularly in the left flank. Tumor is spherical, little flattened, 7 cm. in diameter, about 3 cm. long, extending to iliac crest, skin reddened. Operation; no peritoneal sac but large intestine found. Recovery. Believes it came out through Petit's triangle.

31. FRIEDENTHAL: Female, aged forty-five. Injury to the spine by fall, and six years later strangulation in lumbar region appeared. Patient could not give any

history of hernia. Cherry-sized hernia in left side, under twelfth rib, attributed to weakening of the muscles following frequent pregnancies and the indirect traumatism of the fall.

32. SECOUSSE AND LASSERE: Male, age not given, carried heavy weight upstairs, three days later noticed a small tumor in left lumbar region about the size of a nut. Ten days later it was the size of a pigeon's egg. This was three years ago and now it has increased very much in size. Round, about the size of two closed fists, becomes larger when patient coughs, and spreads widely over the lumbar region. Reducible and gurgling, non-painful.

33. GOODMAN AND SPEESE: See above.

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ON PERFORATING AND VARICOSE ULCERS OF THE LEG AND THEIR TREATMENT BY NERVE OPERATIONS

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The value of nerve-stretching in the surgical treatment of trophic disturbances is brought into prominence by the results of operations in the two categories of affections, for which A. Chipault has first recommended them, founded on a scientific method; namely, in the malum perforans pedis and the ulcera varicosa.

Until now, the sphere of trophic disturbances has been under the influence of hypotheses. Passing over in silence the theory of Marinesco concerning their nature being too complicated to allow the formulation of a working rule, efficient in practice, we may lay stress upon the clinical facts, which show the trophic disturbances to be the result of alterations in special vasomotor nerve-fibres most in keeping with surgical experience. According to this opinion, nerve-stretching as a therapeutical measure against trophic disturbances is to be considered as a method of the surgery of the sympathetic system. This conception is confirmed by some observations in which trophic disorders have been treated with success by operations on the sympathetic. In that manner Chipault treated with good results an obstinate gunshot wound of the face, by bruising the cervical sympathetic nerve. Jaboulay treated trophic disorders of the foot, which were of a gangrenous nature, by exposing the arteria femoralis and loosening the vasomotor nerves which surround this blood-vessel.

Nerve-stretching is a less drastic operation than splitting up the nerve into its constituent fibres, and than more direct interference on the sympathetic nerve system. In the latter, localization is more difficult, the operation is more dangerous; and the results have yet to be ascertained, whereas they have already been shown to be successful in the cases of nerve-stretching and laceration.

Tests on animals are not necessary to give evidence of the use of Chipault's operation. Perhaps later on they may be necessary to prove the nature of diseases in whose treatment the operations have been shown to be efficient, and the manner in which they produced their beneficial effects; or to furnish proofs of hypotheses of the relations between these operations and the diseases which are thus treated.

We may accept the practical use to be demonstrated, and therefore we must wonder, for instance, at the ulcus cruris being chosen by the dermatologists for their experiments with ointments and powders, where only an intensive surgical treatment can be of lasting use and can prevent relapses. When drawing attention to the trophic influences shown by nerve-stretching in those cases in which this operation was undertaken with another purpose, such as the treatment of neuralgia, the lightning pains of tabes, it is striking how large, in regard to these influences, is an amount of information which has been laid down in literature since 1875. This information gives evidence of the fact, that the trophic symptoms which accompanied the affections for which the operation was performed, either were cured by the influence of nerve-stretching or showed a change for the better. Therefore, properly speaking, it is not necessary to experiment on animals to ascertain the basis of the treatment of trophic disturbances by nerve-stretching.

Besides this, the special causation of trophic disorders in animals gives rise to a special pathology, which does not allow of conclusions regarding the human body, without considerable restrictions.

To conclude, as the treatment of trophic disorders by nerve-stretching was not founded on empirical knowledge, but on well stated clinical experience, trophical disturbances, whether of central or of peripheral origin, may advantageously be treated by this operation.

I. MALUM PERFORANS PEDIS

This ulcer ought to be considered as, more than anything, the prototype of a localized trophic disorder, and, in the treatment of this affection, Chipault first applied nerve-stretching following the preliminary observations of Duplay and Morat, on the nervous origin of perforating sores of the foot. Nélaton first described the affection in 1852* as a separate disease, ~~mal~~ *affection singulière des os du pied,* and Vésigné † has given it the name of *mal perforant plantaire* ~~*sine du pied.*~~ German writers, not satisfied with this name, have rebaptized the affection as neuroparalytic sores. But trophic disturbances do not only appear when a nerve bundle is destroyed, but also when it is in a state of permanent irritation, so that the name malum perforans pedis typifies the affection much better. Let us then in honor of Nélaton and Vésigné preserve this name.

The malum perforans is not a real etiologically limited disease. There may be several causes of this affection. These sores are known to be characterized by their painless course, a preference for penetrating deeply, and obstinately opposing every treatment, whilst they have a

* Soc. de Hop. '52., p. 13.
† " " '52, p. 38.

strong tendency to relapse. Their anæsthesia and analgesia are most characteristic and are not confined to the sore and its near environment, but may also be found in other circumscribed spots of the feet, or on the whole foot. To the due diagnosis of a malum perforans, these nerve-disorders, accompanying the sore, are of the utmost importance.

The sores, as a rule, are situated on the sole of the foot, under the metatarsophalangeal joints, the large and little toe, and the heel; but besides this, they may occasionally be seen in any part of the foot, on the hand, or even in the mouth.

Very often no primary cause can be found, and yet a rank growth of epithelium, with horny induration of the skin, is formed. Under this clavus a suppuration may occur by accidental infection of a bursa mucosa, or other incidental affection. Pus being discharged, a little sore appears, with steep, undermined borders, formed by the horny induration and thickening of the epithelium. The sore does not tend to heal and, though it may seem to be cured, it soon breaks open again, extending down into the deeper layers. Depending on the place of development, tendon-sheaths and joints may be opened, bones may be deprived of their periosteum and become eroded. A transient cure may rarely be obtained. Usually, the sore is neglected by the patient, while it is painless; but gradually it secretes a viscid, bad-smelling matter. These mala perforantia do not rarely, while penetrating, lead to suppuration of the joints, necrosis of the bones or serious gangrene. The sore develops so slowly, that its course may extend over several years.

The neuropathic joint and bone affections were especially esteemed by Levy (Die Entstehung des Mal Perforant du Pied; Mittheilungen aus den Grenzgebieten der Medizin und Chirurgie, 1909. (*Bruns' Beiträge zur klinischen Chirurgie,* 1910, p. 627, Bd. 79) to be of such importance, that he emitted the thesis: A malum perforans is only caused by diseases of the bones and joints. He founded his opinion on 12 cases of malum perforans, in which he demonstrated, having taken radiographs, that in all these cases the mala perforantia coincide with arthropathies.

At a meeting of the Danish Surgical Society (*Centralblatt für Chirurgie,* 1913) Köster read notes of a case of *maux perforants* of the region of the metatarsophalangeal joints of the soles of both feet. The patient, a diabetic of fifty years of age, had suffered from perforating ulcer for nine years, without symptoms of disease of the central nervous system. A radiograph showed atrophy and fractures of the metatarsal bones.

Brutzer (*Deutsche Zeitschrift für Chirurgie,* 1913) communicated a case of lepra in which the patient showed *maux perforants* of both

feet, under the first metatarsophalangeal joints. These joints *were intact,* until in one foot this joint was opened. After resection of the affected joints, patient was cured notwithstanding the atrophy of the soft tissues, because pressure by walking was divided over a greater surface. For this reason the cure was lasting and the function of the foot was saved. On this ground Brutzer discredits the theory of Levy, the existence of joint and bone affections not being necessary. In his opinion a malum perforans proceeds from pressure, exerted while walking, in neuropathic persons, by generally deformed bones of the foot, on the atrophic soft tissues and the skin, situated under it.

As said above, one remarks, besides the sore, several disorders of the nerves. On careful examination, as already mentioned, anæsthesia as well as analgesia, whether of the whole foot, or in the neighborhood of the sores, may be noted, often accompanied by trophoneurotic disturbances of the nails, skin, bones or joints. Moreover, pareses and disorders of the reflexes may be observed. However, all these signs are not to be considered as diagnostic marks of a malum perforans, but as symptoms of the original disease, which are not essential to the diagnosis of perforating sores of the legs. In keeping with this variety of accompanying nervous disorders, the nature of the primary diseases of the nerves shows an equal manifoldness. Tabes, syringomyelia, wounds and diseases of vertebræ accompanied by secondary diseases of the spinal cord, spina bifida, neuritis in its different forms, wounds and growths of peripheral nerves—all these and many others have their place in considering the etiology of perforating ulcer of the foot.

Malum perforans is met with in the early stages of tabes and is situated, as a rule, on the sole of the foot in the region of the metatarsophalangeal joints, frequently under the large toe. It may also appear on other parts of the sole, at the heel or above it, as a little circular sore, gradually increasing in depth, up to, or even including, the bone. The sore is very chronic and almost painless, its cure is tedious. Secondary affections of the joints of the toes and necroses of the bones are by no means rarely seen as sequels of mala perforantia.

Contrary to the opinions in former times, which generally accepted sensory and trophic disorders of the feet as rarer than those of the hands, of late years many publications have been made, giving evidence of cases of malum perforans in syringomyelia, localized, just as in tabes and peripheral neuritis, on the soles of the patient, as seen in a typical case which I treated.

As to the combination with rarer diseases of the central nervous system, it may be mentioned, that I am treating in hospital a case of

malum perforans in a patient suffering from spastic spinal paralysis, a disease extremely rare in a Japanese, and a combination yet rarer in pathology.

We cannot wonder that Eichhorst and Schwarz, having observed the malum perforans pedis (as the cause of death) in a case of myositis ossificans progressiva, considered this disease a trophoneurosis (Nicoladoni) or an after effect of diseases of the spinal cord (Eichhorst).

But properly speaking, the malum perforans belongs to the phenomena of disease most common in the course of a neuritis, although when looked at in the proper light, it cannot be considered as a sign of value in the differential diagnosis of neuritis from tabes. In the several forms of neuritis malum perforans is most common in cases of alcoholic neuritis and diabetes, but is also occasionally seen in leprosy. Several neurologists, as Cassirer (Neuritis and Polyneuritis, *Deutsche Klinik,* VI, p. 1007), express their opinion very cautiously as to the etiological relations between alcoholism and malum perforans. It seems, Cassirer says, to occur in relation to a chronic alcoholic intoxication. Adrian prefers in his essay (Das Mal perforant du Pied, 1904) not to explain such cases as of neuritic origin, but as due to an altered hæmatopoiesis.

Jeannel and Kirmisson first drew attention to the neuritis, often occurring in the course of diabetes and giving rise to a malum perforans. But Cassirer (*loc. cit.,* p. 1051) also expresses his opinion on their connection with a diabetic neuritis with some reserve and says: in the explanation of the genesis of a trophic disturbance, it is necessary to take into consideration, besides the alteration of the nerve, another circumstance, and this is a mechanical action by pressure—at all events on tissues already injured in their capacity for resistance, by nervous or other influences. Perforating ulcer of the foot has no clinical significance in neuritis, as it is only exceptionally an accompaniment of sciatica and even more rarely of polyneuritis But these sayings of the neurologist are by no means established by surgical experience. After all, we have in surgical literature hundreds of well described and exactly observed cases of mala perforantia, occurring in alcoholism and diabetes. Now it is quite possible to construct many hypotheses in explanation of these facts, but it is impossible to reason away the plain truth, mentioned above; and when we see nerve-stretching to be of preponderating therapeutic effect in the treatment of this affection, we must indeed accept the conclusion, that nerve diseases, whether localized in the whole

bundle of the sciatic nerve or in its vasomotor fibres only, have a connection with these disorders.

The surgical facts, observed with irrefutable certainty, cannot be explained by an altered hæmatopoiesis, as accepted by Adrian and Cassirer, but very well by disorders in the nerve. So we are strictly within our rights, when sustaining the thesis: that the neuritis occurring in diabetes and alcoholism very often gives rise to a malum perforans pedis, as may be seen from the tabular statement of my cases at the end of this paper. Especially in diabetes, perforating sores of the foot are very frequent.

As to the malum perforans in leprosy, formerly it was called a leprous sore. Wrongly, indeed; then it is not caused by the bacillus lepræ as such, but by the nerve disorders occurring in cases of lepra anæsthetica. Deycke believes these affections of the soles of the feet to be a peripheral disturbance. The trophic ulcers of leprosy, which are entirely comparable to trophic ulcers of other origin, especially in their chronicity, do not prove anything against the peripheral-neuritic conception of nerve-leprosy. Consequently this eminent expert in leprosy considers, according to surgical clinical experience, that malum perforans pedis in leprosy is caused by a peripheral neuritis.

Many points in question concerning the perforating sore of the foot are yet unexplained, although they have their significance in the treatment. I have observed in my hospital many cases of malum perforans of the heel and of the toes, but especially of the toes, to which the current etiological considerations were not appropriate. The number of those suffering from beriberi, which sickness was the cause of nervous disorders in the legs with ataxic signs, must not be neglected, and proved beriberi to be one of the etiological possibilities of malum perforans.

Typhus has not yet been recorded as an etiological factor; but I have notes of two cases in my practice in Europe.

Besides neuritis, peripheral lesions of nerves may give origin to malum perforans. Bennecke observed a case of trophic malum perforans after a peripheral gunshot wound of the sciatic nerve with a slight paresis of the leg and analgesia of the lower parts, especially of the foot. Chipault described a similar observation, and I treated an identical case.

With regard to former ideas of malum perforans, a consideration of Tillaux's communications makes it clear that he attached too much value to the symptoms without tracing their origins. Tillaux believed the real origin of malum perforans to be mechanical. It develops under the influence of repeated pressure in persons who walk much and whose

feet have an irregular form, whether congenital or acquired by the weakening of some muscles or groups of muscles.

This may be true, but usually a malposition of the foot, or a limp, will prove to be caused by disturbances of the nerves—usually neuritis. Or the disorders of gait have mechanical causes, deformities of the bones or joints and, accordingly, we might fancy the nerve disorders to be the effects of chronic pressure, by abnormalities of the gait, on small nerve roots, giving origin to a neuritis, which remains at first circumscribed, but tends to spread. Then the source of trophic disorders is obviously on the spot where pressure gave origin to a *mal perforant plantaire.*

On the foot and chiefly in the sole, many other causes of sores are met with; such sores also are very obstinate and penetrating. They are clinically very different from malum perforans and, by attending especially to analgesiæ and anæsthesiæ, they will not easily give rise to error.

In the tropics perforating tropical sores may be found in the sole of the foot. They have, however, their own characteristics, consisting in a peculiar clinical course with microscopical evidence of the symbiosis of Le Dantec-Vincent. This affection I have described *in extenso* with evidence founded on the records of 241 cases, exactly observed and microscopically examined (*Geneeskundig Tijdschrift voor Ned.-Indie,* 1914, p. 674). These sores always avoid the horny indurated sole, the favorite site for perforating ulcer.

Moreover, we may at first have some difficulty in distinguishing mala perforantia from syphilitic sores and carcinomata of the sole, but we have to remember the characteristic course of syphilis and its serum reaction, the test of Wassermann and of Noguchi. As to the diagnosis of carcinomatous ulcers we must not lose sight of the macroscopical and microscopical properties of these growths.

Gangrenous inflammations and sores of the sole caused by an atheromatous degeneration of the vessels, and finally suppurations under callosities of the foot may be met with, originating from little bursæ mucosæ, which are the cause of fistulous ulcers of these cavities and of undermined sores. When neglected, they can perforate joints and sheaths of tendons just like a malum perforans and may even cause necrosis of the bones.

This series of affections of the sole ought obviously to be excluded from treatment by nerve-stretching; this treatment only being efficient in the disorders conveniently grouped under the name of malum perforans pedis.

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The German proposal to rebaptize this affection as ulcus paralyticum is of no practical use, as I already mentioned above, and, besides this, it is yet more adapted to cause confusion and hazy ideas. We must give the French the credit for being the first to show exact knowledge of these affections and for being the first not only to describe them correctly but also to institute an efficient treatment. Is it not a well-known fact that, with all the therapeutical measures undertaken against perforating sores of the leg before 1895, the treatment was generally of no lasting use? A. Chipault was the first who began with nerve-stretching and, although with some modifications, his method has proved to be, till now, the only efficient one in the treatment of *mal perforant*.

The plan of cure consists of two stages. The first stage concerns the disinfection of the sore, the second stage the operation proper, which is divided into two stages, the first of which consists in the nerve-stretching, the second in the direct surgical treatment of the sore. As to the first stage depending on the state of the sore and its extent, it will be a radical treatment or it will not. Usually it is necessary to scrape the sore with a sharp spoon, to remove necrotic fragments of bones, to lay open freely and to scrape out thoroughly the fistulous ulcers. This is followed by a radical treatment with tincture of iodine.

In those cases in which the malum perforans is characterized by acute inflammation and is complicated with a lymphangitis, it is necessary to remove collections of pus, when such are present, and to be satisfied for the moment with a radical cleaning up.

When the sores are cleaned in this way or the floor of the ulcer was already clean, they are treated with a solution of boric acid or of hydrogen peroxide. Strong chemicals must be avoided.

Only after a relatively sufficient disinfection of the sore may we pass to the second stage. This stage consists, first, in the nerve-stretching; second, in the direct treatment of the malum perforans.

This operative treatment requires a general narcosis, as spinal cocainization or injections of cocaine or such like solutions round the nerve-trunks are contraindicated, as having a bad influence on the nerve-trunks and their branches. It is a well-known fact that injections of the above-mentioned solutions may produce sores of the legs in *cobayæ*. Also Schleich's method of infiltration anæsthesia is out of place here.

As to the nerve-stretching proper, we have, in performing this operation, to pay attention to the following principles. The stretching must reach the nerve-trunk in whose trophic area the sore is situated, but must not be done too near the sore; because, as a rule, malum per-

forans is but one of the components of a trophic complex, extending over a more considerable surface than that of a little nerve-branch. Besides this, it may be a matter of indifference to operate in a region of trophic œdema, but it is not at all so to operate in the proximity of a chronic, nearly always infected ulcer. But we must also take care not to operate too far away from the sore, because the effect of the operation, *when only consisting in nerve-stretching,* might thus be insufficient or might even be nullified. When we have indications that it is advisable to operate at a greater distance, stretching has not a sufficient effect and lacerating the nerve-trunks is of much more use. Relapses are apt to occur if this rule be neglected.

In relation to nerve-stretching as a treatment of mala perforantia, we may mention the following nerves, as being of great importance: (*a*) The external and internal plantar nerves at their origin; (*b*) rami digitales of the musculocutaneous nerve; (*c*) external saphenous nerve.

(*a*) *Exposure of the External and Internal Plantar Nerves at Their Origin.*—In the hollow of the heel a finger-breadth below the lowest point of the malleolus, the posterior tibial nerve divides into its two branches—the internal and the external plantar nerves.

To discover these two nerves at the origin, a semilunar incision of the skin is made on a line going down from the point of the internal malleolus, with the concavity above, toward the inner border of the foot, up to the most anterior projection of the axis of this malleolus.

The superficial fascia is divided after having been stretched by external rotation and abduction of the foot, then the director is introduced from top to bottom in the groove containing the vessels and nerves.

Exploring with the finger, it is necessary to feel sure that only the superficial tissue is raised and then the incision on the groove of the director may be made. The vessels are situated, as a rule, above the nerves, only exceptionally beneath.

Now the foot is brought back to the normal position and the vessels, freed by this movement, can be cautiously raised upward and forward, and the nerves easily isolated and treated, whether together or separately.

(*b*) *Exposure of the Musculocutaneous Nerve of the Leg* (*Origin—External Popliteal Nerve*).—The musculocutaneous nerve forms the posterior branch of the external popliteal, first crossing the peroneus longus, then coursing between this muscle and the extensor communis digitorum, to which it gives motor branches, and finally between the peroneus brevis and the extensor communis digitorum; it penetrates the

fascia to take a subcutaneous course, where it divides into eight branches, one providing the skin of the external malleolus, and seven which innervate the dorsum of the toes, each branch providing a half of a toe, beginning at the hallux.

From the head of the fibula to the anterior border of the external malleolus a line is drawn, parallel to the axis of the limb. An incision of ten centimetres involving only the skin is made, on the line mentioned above, terminating four fingers' breadths from the lowest point of the malleolus. Either immediately, or by tearing the loosened borders of the wound, a little to the right or to the left, the twigs of the musculocutaneous nerve, going to the toes, may be observed issuing from an aperture in the aponeurosis, in this case situated in the uppermost part of the incision; or issuing from several apertures, which then are situated one above the other. The upper branches go to the innermost toes (hallux, second toe, internal border of the third). The lower branches are distributed to the external border of the third toe and to the fourth. All spread on the surface of the aponeurosis are perfectly visible and can easily be separated without wounding the superficial veins.

(*c*) *Exposure of the External Saphenous Nerve.*—This nerve has origin in the popliteal space, descends between the heads of the gastrocnemius in a fibrous channel, leaving this at the middle of the calf and going down through the subcutaneous tissues, along the outer border of the tendo achillis, down to the malleolus. Here the nerve gives several twigs to the outer side of the foot.

It unites at a varying height, but always above the tendo achillis, with the cutaneous branch of the peroneal nerve, the accessorial branch of the external saphenous nerve and the terminal twigs of the small sciatic nerve. At its inner side it is accompanied from the beginning to the end by the external saphenous vein.

The outer border of the tendo achillis is the seat of election to expose this nerve, which has already united with the anastomotic nerves, mentioned above. Besides this, the nerve has not yet given off its branches and is situated superficially. An incision of three centimetres long is made, one finger's breadth external to the outer border of the tendon. The lower end of this incision terminates three fingers' breadth above the top of the malleolus.

The incision is made only through the skin and exposes, in the subcutaneous tissue, the nerve accompanied by the external saphenous vein whose branches cross the nerve vertically and are to be spared as much as possible.

When the desired nerve is exposed, it is lifted up with the finger

or with a grooved director. First it is stretched very cautiously by one finger at the peripheral end, then between two fingers. This is the action of nerve-stretching, in which it is useless to strain violently, especially when stretching for a long time. When it may seem advisable to cause a more intensive reaction in the nerves we may divide them into separate fibres. But we must take well into consideration, that very small nerve-trunks support badly the lacerating action of the small rake, an instrument recommended by Gerard Marchant and Marty, so that caution may be exercised in stretching the plantar, musculocutaneous or external saphenous nerves. I prefer an exploring needle to the rake, because the effect of the one-pointed instrument may be watched much better and, if necessary, may easier be modified than the action of the many-pointed rake. Lacerating the larger trunks with a rake offers no difficulties. The sciatic nerve may be teased with any more or less pointed instrument, even by a grooved director.

The second division of the second stage of the operation consists in the immediate treatment of the sore. When the sore is too extensive or when the surrounding skin is too much implicated, the surgeon must be satisfied with refreshing the edges of the wound and opening up the usually funnel-shaped sore with the sharp spoon, by removing all disintegrated and necrotic debris from the bones as well as from the soft parts.

When, however, it is possible to excise the sore entirely and to remove the affected tissue from the surface to the base and to leave only sound and bleeding tissues, it may be possible to bring together the borders of the wound with deep sutures and to unite the skin with a set of fine stitches.

In this way the wound often heals by first intention, and this restoration may be more regularly obtained than one might believe. With patience the borders of these oblique funnels can be brought together, even when they occupy a third of the circumference of the ankle, or are situated in the sole, if their diameter amounts to two or three centimetres. Gradually the skin closes as a result of the tension of the deep sutures and it becomes possible to suture the skin with fine stitches, and, although under strain, necrosis of the skin is of rare occurrence. The only cause of ill success in obtaining healing by first intention is an insufficient disinfection of deeper parts of the malum perforans, but to secure this disinfection, we have the first stage of the treatment, and if care is taken, a failure is very seldom seen.

It is evident that no treatment of the sore takes place and that the ulcer and its neighborhood is kept dressed as long as the nerve operation

is being performed and till the wound is sutured and covered with an occlusive dressing.

We may without difficulty convince ourselves, by a perusal of the literature on this subject since 1852, that a permanent cure of perforating ulcer is not to be obtained by conservative treatment. So it was with the several ancient methods of treatment. And what can be attained with the modern methods, laid down in the literature of late years? Let us submit some of the recent publications to a trial.

Müller (*Deutsche Medizinische Wochenschrift,* 1912) recommends treatment with zinc peroxide. After having washed the sore with a solution of hydrogen peroxide, he applies zinc peroxide powder and dresses with a simple ointment. He succeeded in closing the wound, but the anæsthesia and analgesia remained as before. He does not mention relapses taking place.

Courbon (*Semaine Médicale,* 1913) treated with iodine vapor, but the sore only improved; no cure was attained.

Boziès (*Gazette des Hôpitaux,* 1913) publishes four cases, treated by hot air, which ameliorated, but were not cured. In the fourth of the published cases he had to amputate, because the patient, affected with diabetes, became cachectic and did not react to the " Föhn " treatment.

If these are the only results of the modern treatment, we may conclude that it is of no more use than the older methods.

It is evident, therefore, that nerve-stretching or its modifications is of much more use in support of purely surgical treatment of these ulcers—I refer to my series of cases as tabulated at the end of this paper.

Generally speaking, nerve-stretching is not adapted to the benign cases mentioned by Tillaux. In such cases, in my surgical practice in Europe, I never proceeded immediately to the nerve operation, unless at the same time trophoneurotic, or in general, nerve disorders were diagnosed. In those cases a thorough surgical treatment of the malum was carried out, affected tissues were removed with the sharp spoon and chisel, the projecting points of the joints being chiselled away, when they might exercise pressure on the soft parts; and then foot-gear that fitted the deformed feet and that corrected the gait were ordered.

Such mala perforantia may be cured in this way—this is a well-known fact, which persuaded Lange in his dissertation, composed under the ægis of A. Köhler and Hildebrand (Berlin, 1914), to recommend this method as a general treatment of malum perforans. But in the majority of cases, relapses occur.

In tropical practice it is necessary to have an earlier recourse to nerve operations, especially when, as in my Central Hospital, dealing

with a native coolie population, which does not understand and which does not desire to use orthopædic appliances, not even shoes.

When considering mala perforantia merely as sores, spreading deeper and quicker than ordinary sores, and not keeping in view the nerve disorders as being the cause of these sores, we might be persuaded into treating them without nerve operations, but in this way we shall not attain a lasting cure. Relapses are sure to occur, as experience shows, while by applying the nerve operations, whether nerve-stretching or nerve-lacerating, relapses are almost never noted.

As a rule, my incision to expose the nerve was made at a greater distance from the sores, as suggested by Chipault in his publications. He pronounced the operation of choice to be nerve-stretching of the nervi plantares. As may be seen from my tabular statement, although my operation was usually made at a greater distance, I noted cases in which even this operation proved to be insufficient, and ought to have been supplemented by an operation at a still greater distance.

Amongst others who have had the above failures and successes is Bethag (*S. Jahresbrericht für Chirurgie,* 1906). He twice uselessly stretched the plantar nerves, and found on operating further, and examining microscopically pieces of the tibial nerve removed, that the latter was altered. Properly speaking, it was therefore impossible to expect good results from his stretching operations.

It is obvious that the nervous disorders, as far as they can be identified, ought to indicate the spot where the operation must be made. I had better and quicker results with fewer relapses in my nerve operations, when deviating from the rules suggested by Chipault, who urged that stretching of the plantar nerves was the normal operation in cases of mal perforant plantire; and lacerating operations, instead of stretching, gave still better results.

When we find, contrary to the results of simple surgical interference with these ulcers, that after nerve operations relapses do not occur, we may conclude that these nerve operations have a favorable influence on the nerve disorders which caused the wrong position of the foot, the wrong gait and, by mechanical and trophoneurotic disturbances, the perforating sore.

Indeed, when I may be guided by some cases in my tropical practice, the effect of nerve-stretching is markedly successful in paresis of the peroneal nerves in beriberi; lacerating operations are still more strikingly successful. After all, far be it from me to suggest nerve-stretching or lacerating to be a method of treatment in the neuritis of sufferers from beriberi. As such I never performed the operation, and have not

had the opportunity for it, because in the last two years no new cases of beriberi have been admitted to the Central Hospital.

Besides this I must emphasize the fact that in cases in which I did not stretch, but teased, the nerves, the pains and neuralgias, which Chipault spoke of in his publications, did not occur. I lay stress upon this, because it seems to me that lacerating has a more intense action on the diseased nerves. Yet I will at once admit, a mere nerve-stretching in many cases has proved to be satisfactory, when executed at the right distance from the sore. When obliged by the condition of the malum perforans, or by trophoneurotic disorders of the skin in its neighborhood, to operate at a great distance from the sore, I believe it will be preferable, not to stretch, but to perform a lacerating operation.

I will abstain from giving averages or percentages derived from a relatively small number of observations. I shall confine myself, mentioning in the subjoined statement the forms of diseases from which those patients were suffering and were treated by nerve operations from malum perforans.

In Table I at the end of this paper, the principal particulars are further combined. As the title already mentions, it is not my intention to give in this paper a complete treatise on malum perforans. Hence, only those cases are made mention of which were treated by nerve operations.

Treated by nerve operations:

Men	23
Women	2
Total	25

These 25 patients were suffering from:

Diabetes	4
Alcoholism	2
Diabetes and alcoholism	2
Diabetes and arteriosclerosis	1
Alcoholism and injury of sciatic nerve	1
Alcoholism and injury by a shoe nail	1
Tabes	2
Syringomyelia	1
Typhus	1
Typhoid	1
Beriberi	8
Spastic spinal paralysis	1
Total	25

In all cases medical attendance began with surgical treatment of the malum perforans and a rest cure. Only when this treatment did not result in healing, I passed to stretching or laceration of the nerve-trunk in the region of which the malum perforans was situated.

This operation was always accompanied by a further thorough surgical treatment and extirpation of all the diseased parts. If such operations proved insufficient and in cases of relapse, the nerve operation was repeated at a higher level, generally not as nerve-stretching, but as nerve-lacerating. In this way were performed in 25 patients 33 nerve operations, by which the mala perforantia finally were cured.

Here I lay stress upon two facts:

(1) The mere local surgical treatment was shown to be useless in all these cases, even when combined with an absolute rest-cure.

(2) The same surgical treatment combined with a nerve operation, whether executed once or repeatedly, always led to cure.

Naturally, the ultimate fate of these sufferers from central nervous diseases is not discussed here; it is evident that such central disorders cannot be influenced by peripheral operations.

The tabular statement below gives details of 33 nerve operations performed on 25 patients suffering from perforating ulcer.

Nerve-stretching:

External saphenous nerve	16	
Posterior tibial nerve	4	
Musculocutaneous nerve	1	
Plantar nerve	3	
	—	24

Nerve-lacerating:

External saphenous nerve	1	
Posterior tibial nerve	3	
Musculocutaneous nerve	1	
Plantar nerve	1	
External popliteal nerve	2	
Sciatic nerve	1	
	—	9
Total		33

II. CHRONIC VARICOSE ULCER

This ulcer is similar in many respects to perforating ulcer of the leg and foot, but the alterations in the vessel walls play a much more important part than they do in perforating ulcer.

A number of accessory signs hint in the direction of trophic dis-

orders, and those who have realized the excellent results afforded by a judicious combination of nerve-stretching with routine treatment have taken up this combination in the treatment of varicose ulcers and not in vain. Several observers have pointed out the sensory and secretory phenomena accompanying varicose sores. But the signs of morbid processes in the skin in the neighborhood of the sore yet more obviously bear a trophic character, even up to a combination with malum perforans, as has been demonstrated by Tuffier and Chipault; or showing trophic disorders of the bones as described by Reclus; or perifascicular interstitial neuritis as mentioned by Cornil and Ranvier and examined by Quénu and Gombault.

Therefore it is evident that relations of a trophic nature are to be accepted between chronic varicose sores and *maux perforants*. Besides this, every endeavor to treat the despair of all hospitals, the chronic varicose ulcer, with more chance of success must be welcomed with joy, especially when the method of treatment is dependent on the pathogenesis of the disease, which has hardly hitherto been the case. Indeed, the extensive, nearly endless literature on chronic ulcers of the leg, the laudatory commendations of continually renewed remedies, prove beyond doubt that a passion for using powders and ointments put us off the track. A specific remedy will never be found, though one drug may have an apparent advantage above another; the manufacturers derive the most profit from it, the patients the least.

It may be taken as certain that, however manifold the causes of varicose ulcers of the leg and lower extremity may be, their pathology is obscure, to us as well as to Hippocrates (*οἱ Κίρσοι*). It is true that mechanical causes, prohibiting the back flood of venous blood, assume a great part in the etiology of the varices, as also of the varicose sores; but this was already as well known to Oribasius as to us.

Mechanical hypotheses hardly account for varicose veins and for the resultant ulcers; we often fail to find varices in large abdominal tumors accompanied by high intra-abdominal pressure: varicose veins and their skin lesions are as frequent in Europeans as they are rare in Malays and Javanese.

In rather more than a year I have only seen one case of varix combined with a varicose ulcer in over 200 Javanese women confined in hospital. No grave case of varix and no case of varicose sore occurred in 13,260 Javanese coolies admitted during the past two years. The cases of varicose ulcers that I observed in the Dutch East Indies concerned chiefly Europeans, Chinese and Japanese and, exceptionally, natives, *i.e.*, Javanese.

It is evident that other than mechanical factors must here take the lead. And so the nutritional disorders of, and the pains in, the lower extremities, out of proportion to the extent of the varices or of the sores, give a hint as to a nervous causation.

By this is explained that powders and ointments, whatever their nature, are not alone able to cure a varicose sore. By treatment of the varix, we have an expedient for treating varicose ulcers, but not a permanent remedy; and the causative trophic disorders are outside the power of such remedies.

But it is also evident that, in cases in which the long lasting affection has caused considerable mechanical disorders of a permanent nature, it will be impossible to nullify these mechanical disorders by a simple treatment of the trophoneurotic disorder. In these cases it is necessary to treat the trophoneurosis; but besides this, the varices also require surgical treatment. Without this it will be impossible to obtain a lasting cure without or with little chance of relapse.

As to the technical part of the treatment; it will be necessary to pay attention to a previous thorough disinfection, preceding the operative treatment. Dressing with a solution of 1 per cent. potassium permanganate proved very useful in this preliminary treatment, but still more useful were dressings of a solution of hydrogen peroxide. This solution gives evidence of similar advantages as I have observed with it in the treatment of tropical sores. It is not only a powerful disinfectant, but an anodyne also. It is evident this remedy cannot cure, it is only useful in the preliminary disinfection of the sore.

This preliminary treatment having been accomplished, we begin with the second stage, as in the treatment of malum perforans, to be executed in two divisions—first the nerve-stretching, then the direct treatment of the sore.

Chipault urged very rightly that this stage of the treatment should be executed under general narcosis. Local anæsthesia is not suitable to the purpose and anæsthesia of the spinal cord is contra-indicated, because dilated epidural venules, or the like, of the pia mater often occur in sufferers from varices, as Chipault and Manoury have shown, and these conditions are a special contra-indication to this form of anæsthesia.

The nerve-stretching must be applied to the nerve in the region of which the sore is situated, and should not be performed too near to, nor too far from, the sore. When the incision is made too near the sore, we might operate in œdematous or sclerotic tissues and it is possible then to stretch a nerve-branch whose area of supply is too limited. When nerve-stretching is performed too far from the sore, the trophic effect

of stretching may be nullified. It is therefore necessary to select the external saphenous nerve or the musculocutaneous nerve; at all events nerve-roots of the same relative size. But besides this, it is better in cases of extensive varicose sores *to substitute stretching of the external popliteal nerve for stretching of the musculocutaneous nerve,* because the anterior tibial nerve distributes branches, which lie in more superficial layers above the region of the musculocutaneous nerve, and, moreover, provide the deeper layers. It is important to bring these regions under the influence of stretching, in order to act on the terminal branches innervating the coats of the varices in the muscular tissues.

The following nerves come under consideration for nerve-stretching in the neighborhood of the sore: (*a*) *Internal saphenous nerve;* (*b*) *external popliteal nerve;* (*c*) *external saphenous nerve.*

The technic I have followed in exposing these nerve branches is mentioned below, and is the same as suggested by Chipault in his *Traité de Chirurgie du Système nerveux.*

Teasing the sciatic nerve into separate fibres is an operation I have very often performed, always selecting the classic spot on the lower border of the glutei—it is not necessary to detail this well-known operation.

(*a*) *Internal Saphenous Nerve.*—By exposing this nerve when it leaves the femoral canal, it is possible to bring all the cutaneous twigs, collateral and terminal, under the influence of nerve-stretching. The best way is that indicated by Letiévant. The place of choice lies a little beneath the point where the nerve leaves the crural canal and is situated on the adductor magnus, covered only by the outer border of the sartorius. Then the leg must be laid on its inner side and the outer border of the sartorius must be searched for and an incision about six centimetres long must be made along this border, but a little more internally. The end of the incision reaches the lower third of the thigh. Then an incision is made in the sheath of the sartorius and the muscle is drawn toward the inside with a blunt hook. In this way a hollow sheet of fascia is exposed, corresponding with the furrow which separates the vastus internus from the adductor longus, and finally the tendon of the latter is seen. At this spot the white shining tendon of the adductor magnus is easily found, on following down the tendon of the adductor longus. The nerve crosses the tendon of the adductor magnus and may be recognized by its dead white color and the direction of its bundles.

(*b*) *External Popliteal Nerve.*—This nerve can be exposed at several places. When it is not only intended to act upon its terminal twigs, the musculocutaneous and posterior tibial nerves, but also upon the com-

municating peroneal branches, in whose area of supply sores are extremely rare, it will be necessary to expose the nerve above the hollow of the knee, because the communicating branches originate irregularly, their course being for some time parallel to the external popliteal nerve. For this the patient is placed in the prone position. The operator stands at the outer side, flexes the knee and marks the fold. The limb being extended again, he palpates the inner border of the biceps femoris and makes an incision of five centimetres long terminating, according to the side on which the operation is performed, at the right or at the left, two fingers breadth above the knee-fold. The skin, subcutaneous tissues, and aponeuroses are successively and carefully divided with a knife, to spare the cutaneous branches distributed here. Then the inner border of the biceps may be perceived and, as the flexion of the limb facilitates the action of drawing this muscle outwards, the external popliteal nerve and its collateral branches are soon discovered, whether at their origin or, when they divide higher up, during their course parallel to the trunk of origin.

When it is intended to act only on the two terminal branches, excluding the communicating twigs, we expose the external popliteal nerve at the head of the fibula, either behind or beneath.

(*a*) The best way to expose the nerve at the back of the head is suggested by Velpeau. The slightly flexed leg is laid down on its inner side. An incision is made from the beginning of the anterior interosseous space, to the end of the popliteal space. This incision follows the depression which separates the tendon of the biceps femoris from the gastrocnemius, and thereupon crosses the outer side and the front of the fibula, immediately above the head of this bone. To reach the nerve, the surgeon must divide the skin, the subcutaneous fascia and the aponeurosis. The tissues are separated by a probe, and the nerve trunk is easily found between the outer head of the gastrocnemius, below and internally, and the tendon of the biceps with the head of the fibula, above and external; the posterior border of the fibula, or the peroneus longus muscle being visible in front.

(*b*) The best method to expose the external popliteal nerve below the head of the fibula is indicated by A. Chipault, in his *Chirurgie du Système nerveux*. By this method muscles are least injured. The leg is flexed to an obtuse angle and rests on its inner side, so that the head of the fibula protrudes and may easily be palpated. Beneath this capitulum two intermuscular fascial lines coursing lengthwise are to be distinguished more or less easily. The anterior fascial line lies between the extensor communis digitorum and the peroneus longus and the ex-

ternal head of the gastrocnemi. An incision of four centimetres in length is made in the first intermuscular line, terminating at the base of the head of the fibula: it divides the skin, the subcutaneous tissue and the aponeurosis. Then the foot is flexed and abducted, the extensor digitorum communis is hooked forward and aside, the peroneous longus backward; by this manœuvre the nerve trunk is laid bare, having been covered by the last named muscle. The external popliteal nerve is then exposed at the place where it gives off the musculocutaneous and anterior tibial branches. Obviously nerve-stretching at this place has a greater effect than the isolated stretching of the musculocutaneous nerve.

(*c*) *The External Saphenous Nerve* (a branch of the internal popliteal) accompanied by the saphenous vein descends along the posterior median line of the leg, first under, then above, the fascia. This nerve takes but little part in the cutaneous innervation of the leg. Only after its union with the tibial communicating does it supply the foot. Hence the surgeon only has to deal with it when the sores are situated very low. See ineffectual stretching of this nerve in a case of sore (tabular statement). The nerve may be exposed without any difficulty. A longitudinal incision is made at the middle of the back of the limb, beginning three fingers' breadth below the furrow of the knee and following the aponeurosis between the gastrocnemi, which sometimes is visible and often is palpable. The incision is made through the skin, the subcutaneous tissue and the fascia, on a grooved probe; then the vein is exposed and at its side, as a rule at the inner side, the nerve may be found without difficulty.

No special difficulties will be met with in finding the nerves. Only, the considerable circumference of the venous trunks in persons suffering from varices, will make it necessary to operate slowly. In cases of hemorrhage every bleeding vessel ought to be ligatured. The nerve-stretching itself is best done by gently teasing the nerve sheath. In varicose disease caution is especially necessary on account of the small size of the nerve-trunks, and also on account of the nerve tissue which is found in this disease.

The sore, if it is not too large nor too deep, should be removed entire and the wound closed by plastic methods, and sutured. Excision of the ulcer, including any diseased skin, leaves a fusiform wound. The incision is extended twenty centimetres upward to prevent strangulation of the limb. The flaps of skin are loosened and adapted to cover the gap left by the excised sore. The incision does not go deeper than the fascia, but the flaps must be loosened very exactly from it. Any eroded or indurated tissue must be removed by the sharp spoon and scissors,

and the fascia thoroughly cleaned. As to the borders of the wound, which often are the source of considerable hemorrhage in consequence of the dilated vessels, it is necessary to ligature every bleeding vessel with thin catgut before suturing the wound. The fascia and wound must be perfectly dry and free from blood. Thereupon a number of long threads are sutured at intervals through the edges of the wound, using round needles and taking care that the stitches are applied symmetrically. Without tearing or straining, the threads are tied successively. The elasticity of the skin of the lower limb is sufficient for a very extensive plastic operation. In order to relieve the tension when it becomes too great, we may make a long relief incision at the back of the calf.

When the sores were not too large, I repeatedly excised the ulcer in a square form, and after having loosened the flaps of the skin I sutured them in the form of a cross, having displaced them toward the cleaned floor of the sore. If the tension was too great, four relief incisions were made, each between the two sides of an angle. These incisions were then sutured across, and I obtained very good results.

The operations mentioned above are not applicable when the sore is too extensive, and it is therefore impossible to cover the defects of the skin by plastic operations; or when the skin in the neighborhood of the ulcer has lost its vitality by trophic disorders and become weakened and atrophic or thickened and indurated. In these cases we must be content with a cleaning up of the sores by the sharp spoon and cutting away the mortified skin with scissors, removing all necrotic tissue and all tissue whose vitality seems diminished. Then we ought to promote the cicatrization by an efficient treatment of the wound. In the first case, the wound heals by first intention, in the second case, healing is obtained by granulation.

It is self-evident that we have the best chance of restoring the wound of the extirpated sore per primam when operating on small sores. If we do not waste time with ointments and powders, but immediately institute surgical treatment—that is, efficient cleansing of the ulcers—the majority of them being thus promptly and properly treated will prove to be suited to the operation of nerve-stretching and, as experience teaches us, with good chances of cure.

It is also obvious that this kind of sore requires, like the malum perforans, careful after-treatment. To aid the circulation we should raise the affected limb for at least a week. When the wound has closed the patient ought to move about with a dressing that exerts some light pressure. For this purpose, dressing with zinc-oxide-gelatin, as recom-

mended in the old established therapeutics of varicose ulcers, proved to be of great use.

As the British Pharmacopœia, 1914, does not contain an indication of the drugs for preparing this compound, it may be advantageous to give the formula contained in the Pharmacopœia Neerlandica, Ed. IV.

Gelatina oxydi zincici.
Solve calore adhibito, in balneo aquæ
Gelatinæ partes viginti 20
In aquæ partibus quadraginta 40
His adde
Glycerini partes decem 10
Solutis admixe
Oxydi zincici partes quindecem 15
Ante contritas cum
Glycerini partibus quindecem 15
Et tantum aquæ adde ut totum pondus sit partium centum 100

I spread a thick layer of this liquefied medicated gelatin over the leg and cover this while still wet with a thin layer of cellulose wadding, which immediately sticks and forms an immovable dressing. Over the ankles the layer of cellulose wadding is made thicker, in this way preventing the bandages from cutting into the skin when the patient walks. Over the layer of cellulose wadding a bandage of well starched gauze adds the finishing touch to the dressing. The patient remains in bed until the dressing is thoroughly dry.

It is necessary to prevent adhesions developing between the superficial and the deeper tissues by systematic massage which has also the effect of restoring the lost elasticity of the skin and the subcutaneous tissues.

Doubtless there remain some cases, although they may be rare, in which the varices have already reached such an extent that mere nerve-stretching without treatment of the dilated veins proves to be insufficient to insure a lasting recovery.

Operations on varix are only to be performed when indicated by vicious conditions, particularly in cases of insufficiency of the valves of the saphenous vein. In these cases it is evident that such operations should also have a beneficial effect on the cicatrization of the sore.

It follows, too, that nerve-stretching may obviate the necessity for operations on veins which have not yet been too much dilated, as this operation is not only beneficial to the actual ulcer, but further has a restorative influence on the varix itself. The further conclusion in rela-

tion to treatment is: not to perform operations on the veins if they are not indicated by the pathological condition of these vessels.

Finally, I must lay stress upon the fact that nerve-stretching does not absolve us from a thorough treatment of the sore. As claimed above, the sore ought to be disinfected with all recognized surgical precautions—the sclerotic and atrophic borders, all the tissues that have lost their vitality must be removed completely. Otherwise the wound might be reinfected, thus delaying the cure and the trophic effect of nerve-stretching and preventing it from exerting its full activity in favor of the process of recovery.

In this connection I may mention that I have performed the operation of laceration of the nerve in several cases of large painful varix; in these cases I have noted that, not only did the pain cease, but that the dilated veins diminished in volume. With Chipault I believe in a trophic influence on the coats of the varicose vessels, but I also believe in the more intensive action of lacerating the nerve-trunk. I have performed this operation many times and never with any harmful result, but always with notable effect.

Peculiar difficulties occurred in the treatment of a case of ulcus tropicum which developed in the floor of an ulcus varicosum (in a Chinese) externally, between the upper and middle thirds of the right leg. The treatment of the tropical sore was carried out in the usual manner, as I have described in the *Geneeskundig Tydschrift v. Nederl.-Indie,* 1914, p. 709; but without success. This treatment combined with a fenestrated zinc-oxide-gelatin dressing was no more successful. Only after having performed a double ligature of the saphenous vein at the saphenous opening, according to the suggestion of Trendelenburg, and after having resected pieces of the vein, did the sore show signs of getting clean while still exhibiting the well-known characteristics of a chronic tropical sore. Supposing trophoneurotic disorders yet continued their ill effects on the varices in the neighborhood of the sore, thus preventing its cure, I, led by my experience of the effect of nerve operations, exposed and lacerated the sciatic nerve and again cleansed the ulcer with sharp spoon and scissors. The sores did not heal till this was done. But this stage also gave me difficulty. Cicatrization made indifferent progress and this induced me to cut out the ulcer and to do a plastic operation, known by the name of *"forming living elastic stockings."* The sore was excised as a square; the skin sufficiently loosened to allow the flaps being brought into contact and sutured in the form of a cross, without too great tension. To diminish the tension, a relief incision was made from each of the angles of the square; and between them

four small incisions parallel to the sides of the square were made. In this manner the wound was easily covered with sound skin and made a good recovery by first intention, the scars being solid without being tense. Such flaps always heal up well, as experience has taught me in many cases, and they give the considerable security against the subsequent breaking open of the cicatrices. The whole treatment demanded about three months.

It would be useless to publish detailed records of all my operations. I have therefore tabulated them, as I have done with my cases of malum perforans, at the end of this paper. The case I have described above is related to a peculiar combination with an infection of the varicose sore by the symbiosis of Le Dantec-Vincent; and I refer those who wish to know more about my clinical observation on tropical sores to my paper on this subject, to be found in *Geneeskundig Tydschrift voor Nederlandsch-Indie,* 1914, p. 674.

Table II gives notes of patients treated by nerve operation for varicose sores:

Men	7
Women	11
Total	18

In these 18 patients were performed the following 21 nerve operations:

Nerve-stretching:

Internal saphenous nerve	3	
External saphenous nerve	1	
External popliteal nerve	3	
		7

Nerve lacerating:

Sciatic nerve	13	
External popliteal nerve	1	
		14
Total		21

These figures show, in the treatment of varices, that I disagree with the rules given by Chipault. My experience gives me the right to participate in the view of P. Delbet, that operations on the sciatic nerve are the most favorable method of treatment here. These operations on the sciatic nerve are emphatically to be preferred in varices which are of trophic origin, as evidenced by their beginning, course, and development, and by the tendency of their resulting sores to relapse, and

such varices need not only be superficial; internal varices may also be accompanied by trophic ulcers, this being so that any nerve operation must be performed on that part of the nerve which is above the origin of the divisions to the areas of supply in question.

Lacerating the sciatic nerve is sufficiently radical to be followed by an action on its most distant branches. Simple nerve-stretching has by no manner of means such an effect. The action provoked in the nerve-trunk lasts during the cicatrization of the teased nerve-fibres and gives evidence of its reaction on the whole nerve region for a long time. Without any doubt this operation is more efficacious than stretching operations at ordinary distances. By stretching, connections with branches situated above the place of stretching are left untouched, and therefore no curative effects can be expected on varices lying more centrally.

It cannot be denied, my own observations are sufficient to prove it, that the varicose sore and also the varices, when not too far advanced, may be cured by thorough surgical treatment, accompanied by simple ligature of the saphenous vein.

But, if it is impossible to eliminate the harmful trophic effects of a varix on its accompanying ulcer, we cannot expect a lasting cure of the ulcer.

In a review of the progress of modern surgery in the treatment of varices, apart from nerve operations, it must be admitted, as in the publications of Goerlich (*Bruns: Beiträge zur klinischen Chirurgie,* Bd. 44), that only 27 per cent. of the cases are cured and 73 per cent. are improved or lose the subjective symptoms complained of by the patient.

It is evident that the multiple ligation of varicose veins, the technic of which was introduced by Schede and Kuzmik and applied in 155 cases by Secher (*Hospitalstidende,* April, 1915), is only meant for favorable cases. Under general anæsthesia a silk suture (Kuzmik) or catgut (Schede) is passed around the vein, without exposing the vein, and this is repeated at intervals of 2 cm. (Schede) or of 5 cm. (Kuzmik). It is also evident that this method does not reckon with the etiology of varix and cannot be called an improvement.

For difficult cases remains total excision, according to Madelung; but a partial excision of the principal trunks of the dilated veins is also recommended.

According to the figures, published by Stein in his dissertation (*Bostock,* 1902), 50 per cent. of the cases treated after Trendelenburg's method and 80 per cent. after Madelung's method, were cured. Kocher (*Operationslehre,* 1907) suggested a neutralization of the hydrostatic

pressure by tying the vein as high up as possible, to prevent this pressure being exerted through the side branches.

But the percentages of cure, attainable by the well-known methods of treatment, mentioned above, make it clear that improvements are required in the treatment of uncomplicated varices, as in cases complicated by sores.

In my opinion we went astray in these endeavors. Without mentioning the nerve operations, which have not found many partisans except in Latin countries, we have been able to eliminate many imperfections in the operations of extirpation; but the figures quoted above are evidence that modern surgery ought not to be content with simple extirpation of varices, after Madelung's method. This operation, a radical method, founded on sound principles, gives, in my experience, as much as may be attained by an extirpation. It is absolutely incomprehensible, why this harmless operation should be replaced by methods which cannot stand the criticism of general pathological principles. I mean the operations of Tavel (*Deutsche Zeitschrift für Chirurgie,* Bd. 109, earlier published by him in *Correspondenzblatt für Schweizer Aerzte*) and the operation of Mamourian, performed and the results published by Orloff (*Virchow-Hirsch Jahresbericht für* 1913).

Tavel ties the long saphenous vein and excises, quite near the femoral vein, a piece five centimetres long. One or two days after the operation, he injects every two or three days a dose of 10 cubic centimetres of an aqueous solution of carbolic acid into the tortuous vein, if possible into the lumen of the vessels. In this way an artificial thrombus is formed, as also by injections external to the veins; these, however, are more painful and may cause a gangrene of the covering layers of the skin.

By the formation of a thrombus a danger always threatens, as Kocher saw after an operation by which he removed parts of varicose tumors in the calf and performed a high ligature of the long saphenous vein. Getting up from bed, the patient suddenly died from an embolus of the pulmonary artery. This case proves that a ligature of the long saphenous vein is unable to prevent a thrombus formed in the veins of the leg from being carried to any distant vessel and obstructing the circulation there.

Mamourian exposes the long saphenous vein in the fossa ovalis and ties the vessel centrally, seizing it peripherally with a pressure forceps. Then the same vein is exposed temporally above the knee-joint, ligatured peripherally, and seized centrally with a pressure forceps. From this place a large, long probe is introduced into the lumen of the vein, so that this probe appears in the fossa ovalis. The peripheral end is fastened to

the eye of the probe and by pulling and inverting, the vessel is drawn out and removed. Orloff operated thus on three cases with good results. Contra-indications are: inflammations, thrombosis, strong cicatrizations, weak and thin coats of the veins.

The mere mention of these modern methods already teaches enough; they are not improvements in the treatment of varices and are without any importance in the treatment of varicose sores. These methods no more reckon with the etiology than do the methods of Trendelenburg and Madelung, which are easier and better.

That is how the matter stands at present; and therefore I submit that the only modern surgical method of treatment that reckons with etiology is local treatment of the sore combined with stretching or laceration of the nerve, in the region of which this sore is situated.

TABLE I

MALUM PERFORANS

Sex	Age	Race	Etiology	Surgical clinical symptoms	Operation	Results	Remarks
M	65	E	Diabetes, alcoholism	Perforating sore under metatarsophalangeal joint of right great toe	Nerve-stretching of plantar nerve at its origin, appropriate disinfection and preparation of the sore, removal of necrosed bone, excision of disintegrated tissues; suture	Healing of the wound by first intention.	
M	69	E	Diabetes	Malum perforans under left heel extending to the os calcis	Nerve-stretching of posterior tibial nerve; cleansing the sore; removal of necrosed bone	Healing	Too near the malum perforans to stretch the plantar nerve.
M	63	E	Tabes parasyphilis	Behind the head of the fifth metatarsal bone	(1) Nerve-stretching of external saphenous nerve; cleansing the sore with removal of the necrosed bone. (2) Stretching of tibial nerve; resection of the affected head	After (1) healing, but after 3 months relapse at the same place; after (2) cure.	
M	65	E	Syringomyelia	(1) Trophic disturbances of the right foot, multiple sores, œdema, malum perforans under head of first metatarsal bone	(1) Nervi plantares stretched at their origin beneath the malleolus	Healing, but after 2 months relapse at the heel.	
				(2) Relapse at the heel, rapid necrosis of os calcis and astragalus	(2) Mikulicz's tarsectomy	Healing after a year; relapse at (3).	
				(3) Relapse at fifth metatarsophalangeal joint	(3) Stretching of internal saphenous nerve, cleansing the sore and removal of necrosed bone	Healing	Half a year after operation death resulted from bulbar paralysis.
M	47	E	Alcoholism	Perforating sore under fifth right tarsometatarsal joint	Stretching of external saphenous nerve; cleansing the sore and removal of necrosed bone	Healing.	
M	67	E	Diabetes	Perforating sore, inner side of right great toe and between second and third	Stretching of posterior tibial nerve; cleansing the sore and removal of necrosed bone	Healing.	
M	72	E	Diabetes and arteriosclerosis	Outer side of the little toe	Stretching external saphenous nerve; cleansing sore, removal of necrotic bone; head fifth metatarsal bone chiseled away	Healing.	
M	45	E	Alcoholism and injury of sciatic nerve	(1) Oblique gunshot wound of left sciatic nerve; necrosis of left great toe	(1) Arthrectomy of this toe, liberating the nerve from its fibrous adhesions to neighboring tissues	Recovery after a month malperforant	
				(2) After a month malum perforans under head of first metatarsal bone	(2) Splitting up the sciatic nerve at the seat of injury into its fibres; cleansing the sore; removal of necrotic bone	Healing.	

M	60	E	Diabetes	Two perforating sores—(*a*) one under the right hallux; (*b*) one at the outer side of the little toe	(1) Stretching of plantar nerve at its origin beneath the inner malleolus. Cleansing of both the sores and the necrotic bones. (2) Stretching of external saphenous nerve. Again cleansing of b. and removal of necrotic bone of the head of fifth metatarsal bone	(*a*) Healed; (*b*) after a month not yet healed. Healing.
W	50	E	Alcoholism, injury by a shoenail	Under left great toe a perforating sore	Lacerating posterior tibial nerve. Cleansing the wound and removal of necrotic bone of the head of first metatarsal bone	Healing.
M	22	E	Typhus, after which paralysis of the nervi tibiales with pes valgo calcaneus	On both soles of the feet at the inner part of the os calcis a perforating sore with necrosis of the bone visible in the depth of the sore	Lacerating the posterior tibial nerve on both sides with an exploring needle; removal of the necrotic bone with sharp spoon and chisel; cleansing of the sores	Healing.
M	25	E	Paralysis of right nervus peroneus with pes varo equinus recurring after typhoid	Sore under the head of fifth metatarsal bone. Necrosis of the same head	Lacerating the external saphenous nerve with a pointed probe; removal of the necrotic head; cleansing the wound, sutured with three stitches	Healing per primam intentionem.
M	20	J	Beriberi paralysis of nervi peronei, pes varo equinus on both sides	Sore under head and at the outer side of fifth metatarsal bone, right and left	Stretching of both nervi sapheni externi. Cleansing of the sores. Removal of necrotic bone	Healing.
M	25	J	Beriberi paralysis of both nervi peronei; pes varo equinus on both sides	Sores under head and at the outer side of fifth metatarsal bone, right and left	Stretching of both nervi sapheni externi; cleansing of the sores; removal of the necrotic bone	Healing.
M	50	J	Beriberi paralysis of nervi peronei on both sides, pes varo equinus on the left side	Sore under left head and at the outer side of the fifth metatarsal bone	Stretching of the left external saphenous nerve; cleansing of the sore; removal of necrosed bone	Healing.
M	45	Y	Beriberi paralysis of nervi peronei on both sides; pes varo equinus	On both sides sores under head and at the outer side of fifth metatarsal bone	Stretching of both the external saphenous nerves; cleansing the sores; removal of necrosed bone	Healing.
M	60	Ch	Beriberi paralysis of both nervi peronei and pes varo equinus on both sides	On the right side ulcer 5 cm. broad under head and at the outer side of fifth metatarsal bone	Stretching of right external saphenous nerve; resection of head; cleansing the wound, sutured with 3 stitches	Healing per primam intentionem.
M	50	Y	Beriberi paralysis of nervi peronei and pes varo equinus on both sides	On the right side perforating sore under head and at the outer side of fifth metatarsal bone	Stretching of right external saphenous nerve; cleansing the wound; removal of necrosed bone	Healing.

TABLE I—Continued

MALUM PERFORANS

Sex	Age	Race	Etiology	Surgical clinical symptoms	Operation	Results	Remarks
M	30	Y	Beriberi paralysis of nervi peronei; on both sides pedes varo equini	On the left side perforating sore under head and at the outer side of fifth metatarsal bone	Stretching of left external saphenous nerve; cleansing the wound; removal of necrosed bone	Healing.	
M	55	Ch	Alcoholism	Perforating sore under first phalanx right great toe, necrosis of this phalanx	Lacerating the right plantar nerve; at its origin beneath the malleolus; removal of necrosed first phalanx; cleansing and closing the wound with 3 stitches	Healing per primam intentionem.	
M	53	Ch	Diabetes	Two perforating sores—(*a*) under little toe; (*b*) under head of the second metatarsal bone. Both at the right side; eczema of the feet and ankles	Lacerating the posterior tibial nerve; cleansing the wounds; removal of necrotic bone with sharp spoon; treatment of these wounds with tinct. peroxide and of the eczema with Lassar's paste	Healing per secundam in 4 weeks.	
M	45	Ch	Diabetes and alcoholism	Perforating sore on the dorsum of the third, fourth and fifth toes of the left foot penetrating into the metatarsophalangeal joint of the fourth toe	Lacerating the musculocutaneous nerve with a fine pointed probe; cleansing the wound with sharp spoon and scissors; removal of necrotic bone from the fourth metatarsal bone	Healing.	
M	50	E	Locomotor ataxia; parasyphilis	Perforating sore under head of first metatarsal bone on the left; necrosis of a part of this head. The sore is fusiform. The probe penetrates 1½ cm. into this bone	Stretching of the posterior tibial nerve; cleansing the sore; subperiosteal removal of necrotic bone with chisel, amounting to a third of first metatarsal bone	Healing.	
M	30	Y	Spastic spinal paralysis; pes varo equinus of both feet	(1) Perforating sore on the dorsum of the fifth and fourth right metatarsal joints, probe penetrates into the head of fifth metatarsal bone; anæsthesia only of the sore, not in its neighborhood.	(1) Stretching of musculocutaneous nerve; cleansing the wound; removal of necrosed bone	Healing, but after three months relapse.	
				(2) Relapse at the same place	(2) Lacerating the external popliteal nerve. Again cleansing the wound. Reflection of head of fifth right metatarsal bone; suture	Healing per primam intentionem	Still in hospital for his spastic spinal paralysis.
M	25	J	Beriberi paralysis of nervi peronei on both sides; pes varo equinus on the right side	Perforating sore at the outer side of the right little toe	(1) Stretching the external saphenous nerve, scooping out the sore	No result	Still in hospital for his paralysis.
				After operation the sore spread quickly into the joint; necrosis of the toe	(2) Lacerating the external popliteal nerve. Arthrectomy of necrosed toe; wound sewn with 3 stitches	Wound healed per primam intentionem	

TABLE II

ULCUS VARICOSUM

Sex	Age	Race	Etiology	Clinical symptoms	Operations	Results	Remarks
W	45	E	Varices after pregnancy	Varicose sore on the outer side of the back of left lower leg	(1) Resection of the internal saphenous vein, thorough disinfection with a solution of hydrogen peroxide. (2) Laceration of the sciatic nerve; cleansing the ulcer and removing the undermined skin with sharp spoon and scissors	No result. Healing per secundam.	
W	50	E	Varices resulting from pregnancy	Two sores on the inner side of the right lower leg	Resection of the internal saphenous vein; sciatic nerve lacerated; both the sores cleansed	Healing by second intention.	
W	65	E	Varices after pregnancy	For fifteen years a varicose ulcer, 6 x 3 cm., above the internal malleolus of the right leg	Resection of internal saphenous vein; laceration of the sciatic nerve; sore cleaned up with sharp spoon and scissors	Healing by second intention.	
W	70	E	Varices	Inner side of the left lower leg	Resection of internal saphenous vein; stretching of internal saphenous nerve; cleansing the sore	Healing by second intention.	
M	75	E	Varices	A sore in the middle of the right calf 8 x 4 centimetres in dimension. Above this sore a varicose tumor	Resection of the varices between a ligature above and below the varicose tumor. Sore cleaned up with sharp spoon and scissors; laceration of the sciatic nerve	Healing by second intention.	
M	45	E	Varices	Varicose sore, 3 x 6 cm., on the lower outer part of the left leg	Disinfection of the sore with a solution of hydrogen peroxide; extirpation of the base of the sore; excision of the sore; loosened skin flaps drawn over cleansed base of ulcer; suture; laceration of sciatic nerve	Healing by first intention.	
W	60	E	Varices	7 x 5 cm. sore on the front, inner side of the right lower leg	(1) Sore cleansed; internal saphenous nerve stretched (2) Sciatic nerve lacerated; sore cleansed again with sharp spoon and scissors	Recovery and relapse in 3 months. Healed.	
W	56	E	Varices	Sore 3 x 4 cm. on the outer side of the right lower leg, below the ankle	(1) External saphenous nerve stretched; sore cleansed with scissors and sharp spoon (2) External popliteal nerve stretched; sore again cleaned up	No results. Healed.	
W	40	E	Varices after pregnancy	Left inner ankle	Internal saphenous vein resected; internal saphenous nerve stretched; extirpation of the sore, plastic covering of the defect of the skin by forming "living elastic stockings"	Healing per primam intentionem.	

TABLE II

ULCUS VARICOSUM

Sex	Age	Race	Etiology	Clinical symptoms	Operations	Results	Remarks
W	42	E	Varices after pregnancy	Lower outer part of left calf	(1) External popliteal nerve stretched; sore cleaned up with sharp spoon and scissors (2) Sore again cleaned up; laceration of sciatic nerve	(1) Recovery and relapse in 1 month. (2) Definite recovery.	
M	57	E	Varices	Lower outer side of right calf; sore 7 x 5 cm.; large dilated varices on the inner side of the knee	Excision of the sore; extirpation of the bunch of varices, after having placed a ligature above and below; plastic covering of the defect by loosened flaps of skin; laceration of sciatic nerve	Healing by first intention.	
M	46	E	Varices	Lower part of right calf	External popliteal nerve stretched; sore cleaned up by sharp spoon and scissors	Healed.	
M	62	E	Varices	At left malleolus internus	Excision and extirpation of the sore; plastic covering of the square defect—four relief incisions between the sides of the angles; lacerating the sciatic nerve	Healing by first intention.	
M	35	Ch	Varices complicated by tropical sore (see page 567)	Outer side between upper and middle third part of the right lower leg	Ulcer cleaned up; varices extirpated; sciatic nerve lacerated; plastic covering of the square wound, forming "living elastic stocking"	Healing after treatment for 3 months	Published in extenso in *Tydschrift v. Nederl Indie*, 1914, page 674.
W	42	E	Varices	On and above right malleolus internus, 6 x 4 cm.	Extirpation of sore by elliptic incision, plastic covering by the loosened flaps of skin, extending the incision about 20 cm. upwards and a little down the ellipse—relief incision at middle of the calf; laceration of the sciatic nerve	Healing by first intention.	
M	25	Jap	Varices	Two sores: (*a*) on the left lower leg, a chronic, evidently long-existing sore, above the left malleolus internus, tropic disturbances of the skin in the neighborhood of the ulcer; (*b*) sore at the middle of the left calf. A varicose tumor below the hollow of the left knee	Extirpation of the varicose tumor; after radical cleansing of the sore *a*, on and above the left malleolus internus, elliptical excision of the ulcer on the calf *b*, eight stitches in the loosened flaps. This latter ulcus was cured. The other, which could not thus be cured, was cleansed again with sharp spoon and scissors. Laceration of the sciatic nerve	Healing first sore *a* by second intention. Second sore *b* by first intention.	
W	20	J	Varices after pregnancy	At the right outer ankle a sore of the size of half a crown. Varices all over the lower leg, meeting in the hollow of the knee	Resection of the saphenous vein. Radical cleansing of the sore with sharp spoon and scissors. Laceration of the external popliteal nerve	Healing by second intention.	
W	23	E	Varices after pregnancy	Extensive ulcer on and above left malleolus internus	Portions of the dilated saphenous vein resected. Sore cleansed with sharp spoon and scissors; laceration of the sciatic nerve	Healing by second intention.	

A PLEA FOR THE IMMEDIATE REDUCTION OF FRACTURES*

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"Two weeks ago I fell down and broke my leg. We sent for Dr. Primus who came right away and put it in splints. It hurt a good deal that night and the doctor came the next day to set it, but it had swollen so much he thought it was better to wait until the swelling went down. Two days ago he set it and thought it was all right until he had an X-ray taken yesterday, and now he wants to break it over again."

The frequency with which such a history is encountered is only too great and explains to a large extent the uncomfortable fact that the majority of our fractures to-day have results that are far worse than they deserve to be. The delay in summoning medical aid, which we meet so often in acute abdominal conditions and in cancer, furnishes no excuse in fractures. The laity usually recognizes the injury and the physician is often there within the hour. The time elapsing between the injury and the reduction of the displacement is more apt to be the result of the laziness of the medical attendant or his failure to appreciate the value of prompt action.

It needs but a superficial knowledge of the pathology of repair to realize the importance of early reduction, and its imperative nature becomes more apparent as we study it more deeply. The microscopical examination by Drs. St. John and Whipple of bits of tissue removed at open reduction by the author has been most illuminating. Let us consider what happens in a fracture of the shaft of a long bone, with displacement of the fragments. As the bone breaks and the fragments are driven by one another, the periosteum is torn across on one side and stripped up on the other. There is more or less laceration of overlying muscles, vessels and possibly nerves; there is hemorrhage from the endosteum, the bone ends, the periosteum, both from its torn edges and where it was stripped off the bone; there is hemorrhage into the soft parts, infiltrating along the fascial planes. The distance at which late ecchymoses appear illustrates the extent to which this infiltration occurs. This represents the stage of injury and is almost immediately followed

* Read before the New York Surgical Society, January 26, 1916.

by the earliest stage of repair with the formation of the clot and the further infiltration of the soft parts with serum, giving rise to the swelling and œdema. The formation of a fibrin network or trellis and the appearance of young connective cells advancing into this area is but the question of hours and the rapidity with which the clot may become organized is astonishing. This newly organized tissue fills up the space between the bone ends, the region of stripped-up periosteum, and obliterates the dentations of the fragments so precious to the accurate interlocking of fractured surfaces. The actual deposit of lime salts and the appearance of osteoid tissue may be seen on the third day. This is not the orderly dense bone that shows in an X-ray, but tissue which is dense enough to prevent accurate apposition.

The effect of early reduction of the displacement is twofold; a much more accurate apposition can be obtained and the amount of hemorrhage, and hence the amount of new-formed tissue, will be tremendously decreased. During the first hour after injury, while the adjacent muscles are still soft and free from œdematous infiltration, the ease of reduction is very marked. Much of the pain following fractures is due to the tension of the swollen soft parts and with early reduction this is noticeably diminished. By lessening the amount of necessary repair solid union is greatly hastened. This is all well illustrated in fractures where there is no displacement. There is but little swelling, pain or callus and solid union is rapidly obtained.

The odious dictum, "*wait till the swelling goes down,*" has been the cause of more permanent deformities and more lasting disabilities than its author should care to contemplate. A fracture with displacement should be considered as much of an emergency as an acute appendicitis or a perforated ulcer.

That the reduction can be carried out more efficiently and more gently if the exact nature of the injury is known from the examination of good X-ray plates is without question. And with such evidence at hand much quite unnecessary and harmful manipulation can be avoided in the examination of the injured part. In view of these facts every hospital should have facilities for taking and immediately developing X-ray plates at any hour of the day or night. But if an X-ray plate is not available the reduction should be attempted without waiting for it. The advantages of the early reduction usually outweigh those of the preliminary X-ray.

The question of the best time for an *open reduction* of fractures is quite different. The element of possible infection is here encountered and delay is wise until the body has had a chance to marshal her forces

of repair and resistance, and the injured area is entrenched behind the zone of infiltration. The organizing tissue between the fragments can be removed at operation and accurate apposition obtained. Moreover, were early reduction practised generally, the number of open operations required would be almost decimated.

Summary.—Immediate reduction of fractures with displacement results in easier and more accurate apposition, less pain, less swelling, less reparative tissue formation and a more rapid, solid, bony union.

TREATMENT OF INJURIES IN THE VICINITY OF THE ELBOW-JOINT

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Injuries in the vicinity of the elbow-joint are frequent and should always be viewed with grave concern from the stand-point of the ultimate result. In the majority of cases good results are obtained under ordinary methods of treatment, but in quite a large number of cases ankylosis is a not uncommon result.

Helferich[1] in 1893 first put arthroplasty upon a rational surgical basis by the interposition of soft parts in a case of temperomaxillary ankylosis. Eight years later Murphy[2] interposed fascia in a case of ankylosis of the knee-joint. The following year Quenu[3] performed the first operation of this character upon the elbow-joint. The magnesium sheets of Pupovac, Gluck's ivory pegs and Baer's[4] chromicized animal membrane have been abandoned by most surgeons because of unsuccessful results in their hands.

On account of the gratifying results obtained by operative measures in ankylosis, advice is sought in many cases which formerly it was impossible to follow, and we are now in a better position to decide as to the relative merits of the various methods of treatment, each of which has its ardent advocates.

Here as elsewhere in bone surgery, the most important question is—when shall we resort to the open operation? There are certain injuries in which operative measures give the best results and others in which operation is not needed. We shall therefore try to define those cases in which, in our experience, operation is imperative for the best results and those in which it is not; likewise a brief outline will be made of the operations which in our hands have proved most successful.

Just as the question of structure determines to a large extent the presence or absence of movement in joints, so in tracing their development it will be found that the manner of their appearance forecasts their ultimate destination as immovable or movable arrangements.

The elbow in common with all other joints arises in mesodermic tissue which has undergone more or less differentiation. From the out-

set it presents distinct skeletal units from which the special structures of the joint are derived.

The cell mass which constitutes the joint unit presents the appearance of a thick cellular disk, from this mass the investing ligaments, joint cavity and synovial membrane are formed. The synovial membrane is a highly specialized structure whose function it is to secrete a lubricating fluid, and therefore its position is determined by the essential proximity to a direct blood supply.[5]

The elbow-joint provides an instance of a diarthrosis capable of performing the movements of flexion and extension about a single axis placed transversely, *i.e.*, a typical ginglymus diarthrosis or hinge-joint.

The bones which enter into its formation are the humerus, ulna, and radius. The trochlea of the humerus articulates with the greater sigmoid cavity of the ulna, the capitellum of the humerus articulates with the shallow depression or cup on the superior aspect of the head of the radius.[5]

Taken as a whole, the ligaments form a complete capsule which is not defective at any point, although it is not of equal thickness throughout, and certain bands of fibres stand out distinctly because of their greater strength.

The capsular ligament is therefore divided into anterior, posterior, external and internal ligaments. Internal to the capsular ligament there are several pads of fat situated between it and the synovial membrane. Small pads are so placed as to lie immediately in front of the coronoid and supracapitellar fossæ, but a larger one projects toward the olecranon fossæ.

Synovial membrane lines the entire capsule and clothes the pads of fat above referred to, as well as those portions of bone enclosed within the capsule which are not covered by articular cartilage. By its disposition the elbow and the superior radio-ulnar joints possess a common joint cavity. It should be especially noted that the upper part of the neck of the radius is surrounded by this synovial membrane.

The lower extremity of the humerus is furnished with two articular surfaces, the outer of which is a rounded surface called the capitellum, for articulation with the radius, and the inner is a grooved articular surface known as the trochlea, for articulation with the ulna.

The articular surfaces are bounded on each side by the internal and external condyles. Between the internal condyles and the inner lip of the trochlea is the groove for the ulnar nerve. The extensor tendons arise from the external condyle, while the flexor tendons and the pronator radii teres arise from the internal condyle.

On the anterior surface of the bone immediately above the trochlea is a depression, the coronoid fossa, whilst in a corresponding position on the back of the lower end of the shaft there is a hollow space called the olecranon fossa.

The ulna consists of a large superior extremity supporting the olecranon and coronoid processes. The olecranon process lies in line with the shaft. Its posterior surface is smooth and covered by a bursa. Its superior surface receives the insertion of the triceps muscle.

The coronoid process is a bracket-like process which juts forward from the fore and upper part of the shaft. It receives the attachment of the brachialis anticus muscle and to its inner border the flexor sublimis digitorum, the pronator radii teres and flexor longus pollicis muscles find attachment.

In front of the elbow is the termination of the brachial artery with the radial and ulnar branches into which it divides. To the outer side of the main vessel is placed the tendon of the biceps, and to its inner side the median nerve. The ulnar artery leaves the space by passing under cover of the pronator radii teres, the radial artery is continued downward beyond the apex of the space overlapped by the supinator longus. The median nerve disappears between the two heads of the pronator radii teres, and the tendon of the biceps inclines backward between the two bones of the forearm to reach its insertion into the radial tuberosity.

The musculospiral nerve, the anterior branch of the superior profunda artery and the recurrent branch of the radial artery lie deeply in the interval between the supinator longus and the brachialis anticus. Immediately below this point the musculospiral nerve divides into its terminal branches, the radial and posterior interosseous. The anterior branch of the anastomotica magna and the anterior ulnar recurrent artery are placed under cover of the pronator radii teres.

The ulnar nerve enters the forearm between the olecranon and internal condyle of the humerus and then passes between the two heads of the flexor carpi ulnaris. Behind the internal condyle the posterior ulnar recurrent anastomoses with the posterior branch of the anastomotica magna and the inferior profunda.

The posterior branch of the superior profunda and the posterior interosseous recurrent anastomose behind the external condyle.

In the examination of injuries of the elbow-joint we must think of the following possible lesions:

1. Fractures of lower end of the humerus: (*a*) Supracondyloid fracture (more or less transverse of the shaft above the condyles); (*b*) T- or V-shaped fractures; (*c*) epiphysial separation; (*d*) fractures of the external or internal condyles and epicondyles.

2. Lesions of the radius and ulna: (*a*) Dislocation backward of the radius and ulna; (*b*) fracture of the upper third of the ulna, with or without dislocation forward of the radius; (*c*) dislocation forward of the upper end of the radius; (*d*) fracture of the olecranon process of the ulna; (*e*) fracture of the neck or head of the radius; (*f*) subluxation of the head of the radius; (*g*) fracture of coronoid process of ulna.

3. Simple sprains of the elbow.[6]

Supracondyloid fracture may occur from a fall upon the outstretched hand or a fall upon the elbow. In the first variety we are very apt to have it accompanied by laceration of the brachial artery and by severing or compression of the radial, median and ulnar nerves.

Savarian[7] reported 4 cases of injury to the nerves. Berard[8] reported 7 cases. The upper fragment is usually displaced forward so that its sharp end is usually fixed in the skin in front of the elbow, or actually penetrates it.

In the flexion variety the deformity is usually just the opposite, the upper fragment being displaced backward and the lower forward. Usually ether or nitrous oxide is necessary for reduction.

In the extension variety where the upper fragment is displaced forward, draw the forearm and lower fragment downward and forward and push the upper fragment back.

In the flexion variety draw the forearm down and push the lower fragment back and upper fragment forward.

If much swelling is present, evaporating lotions and rest in bed are ordered until the swelling is reduced. The fragments are held in position with an anterior angular splint. While the above method answers nicely in many cases, there are some remaining where reduction cannot be performed, and another class of cases in which there is a compound fracture where the humerus protrudes anteriorly, in which we hesitate to push the infected upper fragment back into the wound.

In the latter class of cases we paint the protruding bone with tincture of iodine, put on an aseptic dressing, and put the patient to bed for a week.

If no infection has occurred, then try to reduce. If infection has occurred, open up as much as necessary for drainage and wait.

Very often when the time arrives for attempting reduction the fragment will not go back, and in these cases we should operate.

Make either an external lateral or posterior incision. The posterior is the most generally accepted, but we prefer the lateral, although as a matter of fact it makes very little difference which one is used, both have their advantages.

If the external is decided upon, make the incision upon the outside of the arm, avoiding the musculospiral, radial, and posterior interosseous nerves.

To map out the course of the musculospiral nerve, first mark the point where it pierces the external intermuscular septum, viz.: the junction of the upper and middle thirds of a line extending from the insertion of the deltoid to the external condyle, from this point draw a line obliquely downward and forward to the front of the external condyle where the nerve divides into its radial and posterior interosseous branches.

It is rather surprising to one unaccustomed to use this incision, how far forward the nerve lies. After the incision is made, work in and around the lower end of the humerus with the finger, free it and cut off enough to allow full flexion of the arm. Dress in extension for several days until the pain and swelling subside, and then in the Jones position. Begin passive motion at the end of three weeks.

Intercondyloid, T- or V-fractures are usually due to direct force applied posteriorly. If the intercondyloid fracture is a mere fissure, the displacement is like that of an ordinary supracondyloid fracture and the treatment described for it applies here. If there is a marked displacement of the condyles and they are crushed into many fragments the treatment outlined for fractures of the condyles applies.

Up to the eighteenth year when there is a fracture in the neighborhood of the elbow-joint, the chances of its being epiphysial are about 25 per cent. The lower epiphysis of the humerus develops from four centres of ossification. That of the capitellum appears in the third year; the internal epicondyle in the fifth year. The centres in the trochlea and external epicondyle appear in the eighth year.

After the eighth year a displacement of the capitellum and external epicondyle may occur together. After the thirteenth year there are only possible epiphysial separation of the three coalesced nuclei (external epicondyle, capitellum and trochlea) and the internal epicondyle. From the sixteenth or seventeenth year and up to the eighteenth or nineteenth year only epiphysial separation of the internal epicondyle is possible because the internal epicondyle does not unite until the seventeenth year.

The lower fragment is usually displaced backward, as in supracondyloid fractures. The treatment is rest in bed with the arm in extension for a week and then the arm is placed in the Jones position. Motion is begun at the end of the third week.

Fractures of the external condyle run into the joint and the capitel-

lum is usually broken off. This injury occurs most frequently in children. The treatment consists in extension in bed for a week and then dress in Jones position.

This applies to the ordinary case without much displacement, but in some cases the condyle is displaced so that it is wedged in front of the joint and very little or no motion is possible. The musculospiral nerve or its branches are not infrequently torn or compressed.

In these cases, without injury to the nerves, we should give an anæsthetic and try to reduce the fragment. If reduction is impossible, operate. Make an external incision avoiding the musculospiral, radial and posterior interosseous nerves, dissect the muscles apart and remove the fragment. Unite the supinator longus and extensor carpi radialis longior to the triceps with two or three catgut stitches; in this manner the lower end of the humerus is covered.

We are aware of the fact that we are not following the generally accepted principle in this operation. Most authorities believe that the condyles should be fastened in place and not removed. It has been our experience to find partial ankylosis after this method of treatment, probably because motion has not been started early enough for fear of displacing the condyle. When the condyle has been removed, we put the arm up in the flexed position at the end of a week and begin motion at the end of the third week. The arm has not been weakened perceptibly and excellent results have followed this plan of treatment.

If the musculospiral is torn the symptoms will evidence themselves by lack of use of the extensors and supinators. If the tear is recent, sew the divided ends together; if old and bound down in cicatricial tissue, release it and make a new bed in muscle for it. The nerve may appear normal, its lack of functioning being due to a kind of stupor. It is claimed that the injection of 1 or 2 c.c. of a 1 per cent. solution of methylene blue will arouse it to normal functioning.[9]

The outer epicondyle is never fractured alone. The inner epicondyle is an epiphysis and not infrequently breaks from muscular action or direct violence. There is very little displacement. They should be treated in extension until the end of the first week. Passive motion should be started at the end of the third week and persisted in until full range of motion is acquired.

The line of fracture runs into the joint in fracture of the internal condyle. In the ordinary case, rest in bed with the arm in extension one week and then in Jones position with passive motion at the end of the third week applies to this injury, but in the cases where the inner condyle is so displaced that the arm cannot be flexed operative interference is justified.

An internal incision is made avoiding the ulnar nerve, which lies in the interval between the internal condyle and olecranon. The nerve should be picked out of the groove and retracted inwardly, the condyle should then be removed. The carrying function of the arm will be lost by removing the internal condyle, but since we only operate in those cases where the condyle is displaced enough to interfere with the motion of the joint, we have followed the plan of removal rather than fixation.

If the ulnar nerve has been injured as evidenced by partial paralysis of the flexor profundis digitorum, total paralysis of the flexor carpi ulnaris and loss of sensation in little finger and half of ring finger, it should be sutured with chromic gut, freed from all adhesions and covered with muscles.

Dislocation backward of the radius and ulna can almost always be reduced by administering an anæsthetic and hyperextending the forearm while it is supinated, the arm itself being steadied by the hands of an assistant. Moderate traction then draws the forearm gently forward while the other hand seizes the elbow and controls the position of the parts.

The arm should be maintained in a flexed position upon a posterior moulded or metal splint. Light passive motion is begun during the third week. Lateral dislocation of both bones of the forearm is very rare and is reduced by traction on the forearm in the hyperextended position followed by flexion and pressure exerted in an inward or outward direction as the case may be.

Forward dislocation of both bones of the forearm is also very rare. Reduction is effected by pressing or pulling the upper end of the forearm downward or backward.

Divergent dislocation of the bones of the forearm is rare and is reduced by direct pressure over the radius and hyperextension of the ulna.

The same treatment applies to dislocation of the radius or ulna alone. In fracture of the upper third of the ulna without dislocation of the radius, the deformity is reduced, using an anæsthetic if necessary.

The anterior and posterior wooden splints or moulded plaster-of-Paris splints are the most frequently employed. A circular plaster cast may be applied in cases where there is danger of moving the fragments, after the swelling subsides.

Where dislocation forward of the radius is present in addition to fracture of the upper third of the ulna, an attempt should be made to reduce it by direct pressure. It may be impossible to reduce it or the

head of the radius may project through the skin; in the latter case, paint with iodine and dress, but do not attempt to reduce. In the former case an arthrotomy may be possible, but where the head projects through the skin it will usually be necessary to resort to resection.

The incision is a posterior one about three inches in length made between the anconeus and extensor carpi radialis. The head of the radius is exposed. If the capsule is interposed, preventing reduction, remove it, reduce the dislocation, suture the capsule if possible and bring the soft parts into apposition about the head of the radius with a few catgut sutures. If a resection is necessary, which is usually the case in an old unreduced dislocation, in one where the head projects through the skin or a case where the bone is separated from the shaft, simply remove the head above the insertion of the biceps. Put in a few deep sutures. Close the skin. Dress in extension for about five days and then dress in a sling. Begin motion in a week. Dislocation forward of the upper end of the radius, independent of fracture of the ulna, and fracture of the neck or head of the radius are both treated according to the plan just outlined.

The non-operative treatment of fractures of the olecranon process of the ulna consists in treating the arm in extension with a well padded anterior splint of plaster of Paris, metal or wood extending from the level of the axilla to the finger tips. The danger of ankylosis is great after this fracture. The patient should be kept in bed for ten days. The anterior splint should be used for four weeks, once a week it should be removed, the elbow massaged and the splints reapplied. Passive motion should be very cautiously used at the end of the fourth week.

The best results in this fracture will be secured by treating all cases with extra-articular operation.

Murphy's operation is as follows: A longitudinal incision one-third inch long on the outer side of the ulna down to the bone; one-half inch from the articular surface make a corresponding incision on the inner side. The ulna is perforated between these two cuts with a drill; pull a wire or kangaroo tendon through the drill hole. The wire is carried upward under the skin on the inner side of the elbow to the tip of the olecranon. The wire or suture is then passed through the upper puncture transversely through the triceps tendons and emerges on the outer side. The wire is once more reintroduced and emerges at the original incision. The site of fracture is now encircled with wire or suture. Tighten and twist if wire, cut the ends and bury the knot.

The arm is immobilized for four weeks in the extended position, with passive motion on the third day.

Subluxation of the head of the radius is reduced by direct pressure. If irreducible it is treated like a dislocation forward of the end of the radius.

Fractures of the coronoid process are rarely observed. The treatment is by an anterior splint, the angle of which is less than a right angle. Jones' position may be used in treating such a case.

Simple sprains of the elbow are treated as sprains elsewhere, by rest and evaporating lotions.

In conclusion it should be said that bandages and splints are largely responsible for the stiffness following upon joint injuries, and that the best results are observed by dressing in acute flexion as soon as the acute symptoms have subsided, during which time they are dressed in extension.

The arm is dressed in flexion by fastening a bandage around the wrist and neck, first feeling to see if the radial pulse is perceptible.

Ankylosis, partial or complete, may result from prolonged immobilization, the muscles contracting and becoming fibrous, the fascia and ligaments about the joint shortening, the capsule shrinking and thickening, some of the cartilages becoming fibrous and the joint being partly obliterated. It may result from extravasation of blood into the joint and tendon sheaths with subsequent formation of fibrous tissue. It may arise from organization of inflammatory exudate within and about the joint and in the sheaths of muscles and tendons.

The best method for preventing ankylosis due to the above causes is passive motion. Many able authorities teach that motion should not be persisted in beyond the point of pain, but we have found that the point at which pain is first observed is difficult to determine, especially in children, and our method is to move slightly during the third week, a little more during the fourth week and during the fifth week get full motion as nearly as possible, whether it causes pain or not.

Passive and active motion are used until we are convinced that we have secured as wide a range of motion as possible, and this period of treatment generally extends over many months.

Ankylosis may arise from the formation of callus or displaced fragments. Bruns claims that in fracture into the joint excess of callus rarely forms and that masses of callus form chiefly in the line of fracture near but not in a joint.

Formation of excessive callus and fragments displaced so as to interfere with the motion of the joint demand operation, and to experiment with different methods of massage, splints and positions are derogatory to our judgment and hazardous in the extreme to the welfare of the

FIG. 1.—Case I. Firmly ankylosed joint two months after injury. Shows extent of flexion before operation. Paralysis of supinators and extensors existed, due to rupture of the posterior interosseous nerve.

FIG. 2.—Case I. Extent of flexion after operation, also full power in supinators and extensors following suturing of posterior interosseous nerve.

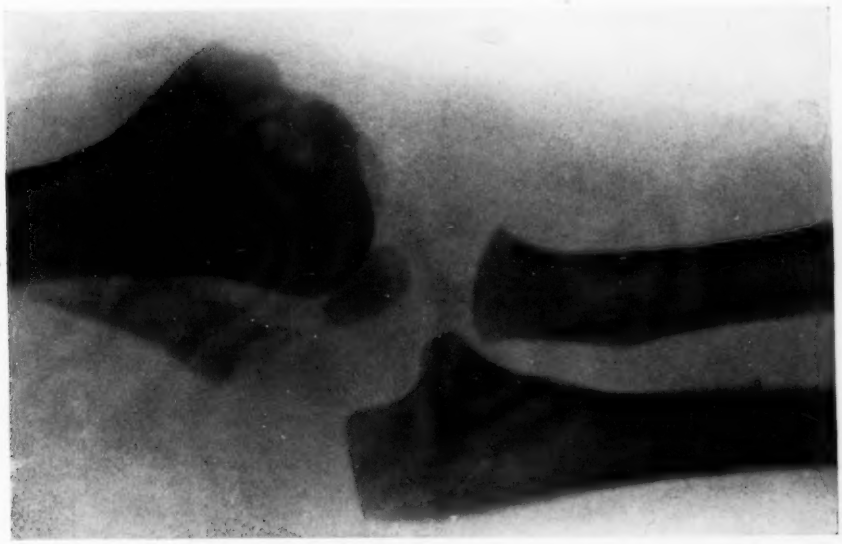

FIG. 3.—Case I. Shows lateral dislocation of both bones of forearm and fracture of the external condyle.

FIG. 4.—Case II. Arm in extension, two months after operation.

FIG. 5.—Case II. Extent of flexion, two months after operation.

FIG. 6.—Case II. Shows supracondyloid fracture of the humerus. The lower end of the humerus projected through the skin.

FIG. 7.—Case III. Extent of flexion three months after injury.

FIG. 9.—Case IV. Fracture of internal condyle of humerus. Shows flexion three months after injury.

FIG. 8.—Case III. Fracture of internal condyle.

FIG. 10.—Case V. Fracture of lower third of humerus and upper third of ulna, with dislocation of radius, the end of the radius projecting through the skin. Arthroplasty with interposition of fascia was finally necessary. Result was a fairly useful arm.

FIG. 11.—Case VI. Posterior dislocation of both bones of the forearm. Reduced under nitrous oxide.

patient, since the result will be an ankylosed joint requiring a formal arthroplasty for correction.

NOTE.—We wish to acknowledge our indebtedness to Dr. W. E. Egbert for the X-ray plates and photographs.

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FRACTURE-DISLOCATION OF THE ASTRAGALUS

TREATMENT BY REDUCTION THROUGH OPEN INCISION

By Ernest F. Robinson, M.D.
of Kansas City, Mo.

Excision of the displaced astragalus, whether in part or whole, in cases of fracture-dislocation of that bone has invariably resulted in a flat, distorted and impaired ankle-joint. From the very mechanism of the ankle this cannot be otherwise. The keystone of the arch of the joint has been destroyed or its form altered, and the recipient of such an injury is rendered, to a greater or lesser degree, a permanent cripple. My own experience with this injury had been so unsatisfactory that when the case herein reported presented itself with a fracture and posterior displacement of the astragalus, I decided, despite the weight of opinion to the contrary, to attempt " open reduction," although the fragment of the astragalus was loose and seemed devoid of blood supply. A curved incision was made on the outer side of the ankle and with the aid of a " jimmy " or long periosteal elevator, one surface of which was roughened, the loose displaced body of the astragalus was replaced. Aided by traction made by an assistant on the foot, I found, to my surprise, this was accomplished with but little difficulty, although it had been absolutely impossible by traction and manipulation alone before the ankle-joint was opened. The result as herein shown by the X-ray pictures was so anatomically accurate and the restoration of function so complete that I have felt the case worthy of record.

J. R., machinist, forty-eight years old; General Hospital, admitted November 1, 1913. Diagnosis, fracture of astragalus. The day previous he fell from a ladder, landing on his right foot, between two steel rails. The ankle-joint was forcibly bent forward, the toes coming almost in contact with the anterior surface of the tibia. The astragalus was broken off at the neck and the body of it displaced backward and outward, where it could be felt resting on the os calcis (Fig. 1). The ankle was enormously swollen. Several large blebs developed. Attempts at reduction under a general anæsthetic failed. A temporary dressing was applied. On the seventh day after the accident he was again given a general anæsthetic but reduction was impossible. A four-inch curved incision was made on the outer surface of the ankle. The loose displaced body of the astragalus was brought into position

FIG. 1.—Posterior fracture-dislocation of astragalus.

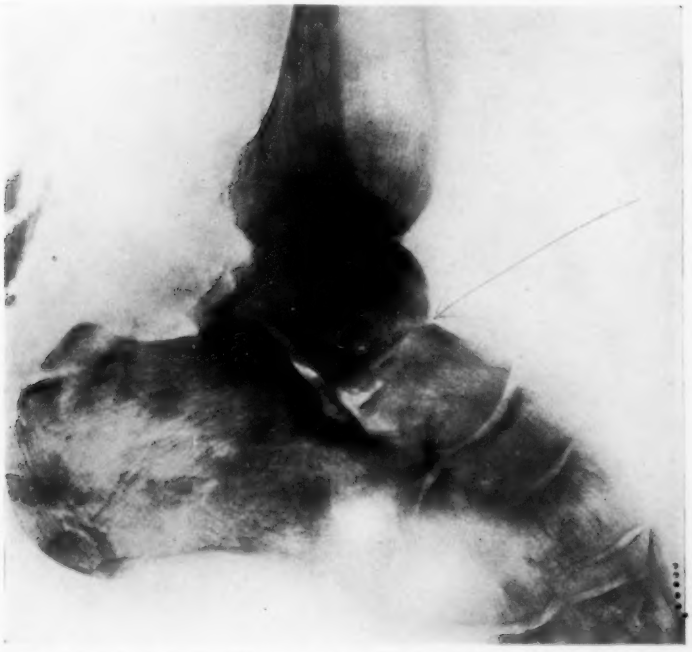

FIG. 2.—Posterior fracture-dislocation of astragalus after operation for reduction.

(Fig. 2) with the aid of traction and a large periosteal elevator, one side of which was rough. This was used as a "jimmy" and was of such service that the reduction was not especially difficult. The wound was closed without drainage and a plaster case applied. The patient left the hospital December 22, 1913, with a freely movable ankle.

Although fracture-dislocation of the astragalus is not common, yet within the past two years I have encountered five such injuries. Of these, three were posterior and two were anterior dislocations, one of the latter also being compound. Excision was performed in three cases with considerable degree of impairment of function in all of them. The compound anterior dislocation became infected and ankylosis, almost complete, resulted. The case in which operative reduction was accomplished resulted in entire restoration of function.

The mechanism by which this fracture is produced is of considerable interest. The patient falls usually from a height, lighting with the foot either completely flexed or extended. The articulating edge of the tibia acts as a wedge, cutting or crushing through the astragalus at its neck. Very rarely the whole bone may be dislocated. This is usually attended by a chipping off or fracture of a portion of the articulating surface of the tibia. If reduction can be accomplished without incision, operation, of course, is unnecessary, but in my experience accurate anatomical restoration is impossible unless the joint is opened. Strict asepis and the avoidance of unnecessary trauma are essential. The open wound is closed without drainage. A plaster cast is worn for several weeks. Its removal at intervals for manipulation and massage after the first two weeks materially aids in preventing ankylosis.

A SIMPLIFIED PRE-OPERATIVE TREATMENT OF THE HANDS AND FIELD OF OPERATION*

By A. D. Whiting, M.D.
and
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A germ-free condition of the skin is not essential to the perfect healing of surgical wounds. The approach to sterility obtained by the various methods and agents that have been advocated from time to time is sufficient to afford rapid healing in a vast majority of cases. Many of the methods, however, are complicated and require considerable time for their execution; some of the agents are applicable to the field of operation alone, and only under certain conditions of the skin; some of them have deleterious effects upon the tissues.

The ideal method would be simple in application, efficient in action, free from deleterious effects, applicable to the wet or dry skin and to the hands as well as to the field of operation, and allow of rapid execution. To be efficient in action the agents used should dissolve or penetrate the débris composed of the secretions and excretions of the glands of the skin, countless broken-down cells and mechanical dirt which surround bacteria on the surface and in the most superficial layers of the skin; they should decompose and remove small particles of air that may be present in the cracks and crevices of the skin and thus penetrate more deeply; they should destroy all germ life with which they come in contact in a short space of time. To be free from deleterious effects, the methods and agents should not be harmful to the tissues, and above all should not interfere with their natural resistive and recuperative powers.

The approach to the ideal in methods or agents must be proved by both clinical and laboratory findings. The clinical results may be judged by the presence or absence of rapid and aseptic healing of the wounds, although it must be remembered that healing by first intention does not prove the absence of germ life. It simply shows that there is sufficient resistance in the tissues to overcome the activity of any bacteria that may be present. Probably the surest, the most positive prophylaxis against wound infection is conservation of the natural resistive and recuperative powers of the tissues.

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* Read before the Philadelphia Academy of Surgery, December 6, 1915.

The laboratory should prove the value of the agents in destroying bacteria, preferably according to the Rideal-Walker coefficiency test, which takes carbolic acid or phenol as a standard and compares the efficiency of other agents with phenol in the ability to destroy the *B. typhosus*. The value of the agent as a germicide "can be expressed by a number called its coefficient which indicates how many times more, or in some cases less, the disinfectant can be diluted than phenol and retain an equal germicidal value." The laboratory should also show the value of the method and agents in either destroying all bacteria in the skin or in reducing them to a minimum, which may be shown, approximately, by imbedding scrapings from the skin in culture media and properly incubating them. We believe that the scraping instrument itself should be imbedded in the medium and that the method of testing which simply rinses the scraping instrument in the medium is faulty and unreliable. To obtain our scrapings both of the hands and the field of operation, we used a roughened strip of mother-of-pearl, this being used because it is readily sterilized in the autoclave, because it can be used repeatedly and because it can be imbedded in the culture medium. To avoid wrong conclusions, all chemical agents used must be neutralized or removed from the skin before the scrapings are taken, because an almost infinitesimal quantity of many antiseptics will be sufficient to prevent the development of bacteria. Scrapings should be taken thirty minutes after the supposed sterilization of the skin to prove that active bacteria have not been thrown onto the surface from the deeper layers of the epidermis. As demonstrated by Leedom-Greene and others, the skin must be moist when the scrapings are taken, because, in a dry condition, the cement substance of the epidermis holds the cells and bacteria in place to a much greater extent than it does when moist. A vigorous 24-hour culture of some easily recognized organism should be rubbed thoroughly into the skin and scrapings should be taken before and after the application of the agents being tested. Finally, a piece of the skin itself should be imbedded in culture medium and incubated for at least 48 hours.

In a former paper ("The local preparation of patients for operation," by A. D. Whiting, M.D., *J.A.M.A.*, August 8, 1914, vol. lxiii, p. 474) one of us reported several series of tests made to show the value of various methods and agents used in attempts to render the skin free from germ-life. These covered the dry method of sterilization; the wet method with the use of different chemical solutions; the combination of the wet and dry methods; and the method of freeing the skin of all bacteria by sweating. Those investigations seemed to

show that the skin could be made sterile by washing it from within outward by stimulating its natural activity, but that no other method of mechanical or chemical cleansing would render it sterile.

After studying an article by Hamilton (*American Journal of Pharmacy,* July, 1915) which grouped the various coal-tar disinfectants, and another by McDonald (*Surg. Gyn. and Obsts.,* July, 1915) which suggested the use of acetone as a solvent and alcohol as a vehicle with the incorporation into an acetone-alcohol solution of a germicide, we have experimented with several solutions in an endeavor to find one that would approach the ideal, or at least would more nearly sterilize the skin than the various methods and agents that one of us had previously investigated, be more simple in application, and allow of more rapid execution.

Hamilton states that since 1889 when the composition of creolin was made known to the scientific world, hundreds of the coal-tar disinfectants composed of creosote oil and soap and containing various proportions of the phenols have been exploited. These phenols are so called because they resemble carbolic acid or true phenol, in composition and action. They differ from carbolic, however, in being but slightly soluble in water, in being less corrosive and less poisonous, and in having greater germicidal power. They differ among themselves according to the coal-tar oil used in their manufacture and the different treatment to which they are subjected to make them soluble in water. Hamilton divides these disinfectants into three groups, according to their efficiency, the third group containing those of a high phenol coefficient. Unfortunately, many of these disinfectants, and especially those of Group 3, are proprietary preparations, the manufacturers keeping secret, for trade purposes, their method of manufacture and treatment, although making strong appeals for the use of a particular one in preference to all others. None of the preparations we have tested, according to our findings, has lived up to the reputation given to it by its proprietor. We wish to make it emphatic that we hold no brief for any manufacturer and that our sole object in mentioning any proprietary preparation is to stimulate interest in the surgical use of coal-tar disinfectants of a high coefficient in the hope that the proper authorities will provide the profession with at least one that is strictly ethical.

The following scheme of investigation was carried out at the German Hospital, service of Dr. Deaver, to whom we are indebted for the free use of surgical material.

Field of Operation.—When not contra-indicated, the field of opera-

tion was wet-shaved and the patient was given a warm tub bath the night before operation. During the day of operation, without further preparation, the field of operation was scraped with the mother-of-pearl strips, which were placed in bouillon and in liquefied agar which was plated. All culture tubes and Petri dishes were incubated at 37° C. for 48 hours.

Results.—All cultures showed a growth of staphylococci.

The field of operation was then surrounded by sterile sheets or towels and the part was rubbed for two minutes with gauze saturated with the solution being tested. The field was then washed off with sterile water or the solution was allowed to evaporate and scrapings were again taken with the pearl strips.

Result.—All cultures remained sterile.

A sterile dressing was then placed over the field and held in place by a sterile bandage. Thirty minutes later, the dressing was removed under aseptic precautions, the skin was moistened with sterile water and scrapings were again obtained with the pearl strips. These scrapings were taken to show whether or not bacteria had been brought to the surface of the skin from the deeper layers through the natural activity of the skin.

Results.—A total number of 446 of these various scrapings were obtained. With the exception of 38, all were returned sterile. Of the 38, one tube showed the presence of staphylococcus and 37 showed contamination. In the series of tests previously reported by one of us, but 2 out of 86 such scrapings remained sterile.

After the completion of an operation on a clean case, a small strip of the skin, including all layers, was removed just before the wound was closed, placed in bouillon and incubated at 37° C. for 72 hours.

Results.—Strips of skin from 117 patients cultured. Returned with no growth, 34; returned with growth, 83. Of the 83, 3 showed staphylococci, 1 streptococci, 58 large Gram positive cocci, 6 small Gram positive and negative cocci, 7 small Gram negative bacilli, 6 small positive and negative diplococci, and 2 sporulating bacteria. The laboratory reported that the majority of the growths were caused by contamination by non-pathogenic bacteria. The wounds of all but three of these cases healed aseptically. Of these three two were cases of acute appendicitis with some exudate and one was a myoma of the uterus in a patient with a very fat abdominal wall.

The Hands.—The hands and forearms were scrubbed with soap and hot running water, a bristle brush being used. The hands and forearms were then washed with the solution under consideration for

two minutes, a piece of sterile gauze being used to rub the skin. The hands were then thoroughly rinsed with sterile water and scrapings were taken with the pearl strip, the person being tested handling the strip himself, rolling it in the hands, scraping the skin, the nail-grooves and the under-surface of the free margin of the nails. The strips were imbedded in bouillon and incubated at 37° C. for hours.

Results.—All cultures were returned with no growth.

The hands were then incased in impervious, sterile rubber gloves. After the completion of an operation, the gloves were removed and similar scrapings were taken. The hands were again washed with soap and water, immersed in the solution, and again incased in rubber gloves. After each operation, scrapings were taken as before.

Results.—One hundred and forty-five scrapings were obtained, 96 were returned without growth, and 49 with growth. Of the 49, 5 showed staphylococci, in 3 and 2 successive cultures on different days. The laboratory reported that the growth in the other 44 cultures was due to contamination by non-pathogenic bacteria.

The hands were washed with soap and water for two minutes. Then 10 c.c. of a 24-hour culture of staphylococcus albus was thoroughly rubbed into the hands and allowed to dry. Scrapings were taken with the pearl strips and imbedded in bouillon and in liquefied agar which was plated.

Results.—All scrapings gave an abundant growth of the staphylococcus.

The hands were then treated with the solution under consideration, the solution was washed off with sterile water and scrapings were again taken and cultured.

Results.—Culture of sterile water before being used to remove solution, sterile. All culture of scrapings returned with no growth. Sterile water used in washing off the solution cultured and returned with no growth.

Same procedure on a different day, with immersion in the solution for 30 seconds, one minute, one and a half minutes, and two minutes. All cultures of scrapings returned with a growth of large Gram positive cocci, which the laboratory stated were positively not staphylococci.

Same tests repeated on third day, with same solution and technic throughout. All cultures returned with no growth.

Laboratory tests were made to show the germicidal properties of various agents and various solutions of them. This entailed an enormous amount of work and we wish to express our gratitude to Dr. Damon B. Pfeiffer, the Chief of the Laboratory, and to Dr. Carl

Becker, who so willingly and carefully made all of the laboratory tests for us. There were made 1174 cultures of the typhoid bacillus which had been subjected to the action of different strengths of 23 different agents or solutions for varying lengths of time. All were properly labelled and incubated at 37° C. for 48 or 72 hours.

Results.—Acetone has no germicidal power.

Alcohol in strengths varying from 40 per cent. to 95 per cent. destroyed the *B. typhosus* in less than 2½ minutes.

Acetone 40 parts and alcohol 60 parts destroyed the *B. typhosus* in less than 2½ minutes.

Acetone 40, alcohol 60, and liq. cresolis comp. 2 parts gave the same results.

Acetone 30, alcohol 65, liq. cresolis comp. 5 parts; acetone 40, alcohol 60, and crude carbolic acid 2 parts; acetone 40, alcohol 60, and pyxol 2 parts; acetone 35, alcohol 60, and creolin 5 parts; acetone 35, alcohol 63, and phenoco 2 parts, all destroyed the *B. typhosus* in less than 2½ minutes.

Liq. cresolis comp. gave a phenol coefficient of 2; creolin 1.5; pyxol, a proprietary disinfectant which the manufacturers claim to have a coefficient of 20, has a coefficient of 4, according to our laboratory reports.

Phenoco, another proprietary disinfectant with the manufacturer's claim of a coefficient of 15, has a coefficient of 9 according to our laboratory reports. Phenoco has been placed in New and Non-official Remedies, 1915, by the Council of Pharmacy of the American Medical Association.

As a result of these investigations, we would conclude that none of the various solutions used will destroy all germs of the skin in all instances, but that a solution consisting of acetone, alcohol, and one of the coal-tar disinfectants of a high phenol coefficient is more efficient than any other agent we have ever used for skin sterilization. In such a solution, the acetone (dimethylketone) acts as a solvent of the fatty or oily material of the skin and thus aids in exposing the bacteria to the germicides. The alcohol acts as a solvent; it has the power to penetrate into the cracks and crevices of the skin, as claimed by Braatz, through its ability to decompose and remove small particles of air that may be present; it is germicidal in solutions as weak as 30 per cent., according to Post and Nicoll, in solutions ranging from 40 per cent. to 95 per cent., according to our findings, with its strongest germicidal powers in solutions ranging from 60 per cent. to 70 per cent., according to Leedom-Greene; it also acts as a good vehicle. The coal-tar disin-

fectant that may be used acts simply as a powerful germicide, destroying all bacteria with which it comes in contact in a length of time varying with its coefficient and the degree of dilution.

The advantages of such a solution are many. Patients do not complain of any irritation following its use, although it causes a burning sensation when used on the scrotum. It does not stain the skin. It reduces to a minimum the time consumed in preparing the field of operation, and its method of application is the simplest. It may be used on a wet or dry skin, for emergencies or for cases where the consumption of time in preparing the patient is not of great moment. There is no exfoliation of the skin as is seen after the use of iodine, nor is there any blistering. It may replace all other solutions in sterilizing the hands, although its continuous use causes some irritation in some instances; in others, no effect is noticed; others say the application of the solution gives rise to a decided feeling of warmth. The solution may be used repeatedly, any collected detritus being removed by filtration.

To further hospital efficiency, to save time, to remove the danger of faulty technic in complicated methods, and to save expense, we would suggest that a solution consisting of 35 per cent. acetone, 1 or 2 per cent. of a coal-tar disinfectant of a high coefficient, preferably phenoco, with enough alcohol to make 100 per cent., would answer the purpose. The method of application consists in rubbing the field of operation for two minutes with a piece of gauze saturated with the solution after either a wet or dry shave. A warm, cleansing tub bath is, of course, always advisable when not contraindicated.

DOUBLE UTERUS AND VAGINA WITH A NEW BLOODLESS OPERATION FOR THE CORRECTION OF THE DEFORMITY*

By A. E. Rockey, M.D.
of Portland, Oregon

Two cases of this malformation have come under my personal observation. Beyond the vague statement by several text-book authors that it is fairly common, my library contains no statistics of its relative frequency. The index of the first sixty volumes of the Annals of Surgery makes no mention of it. In Ashhurst's System of Surgery, in the gynæcological section, written more than thirty years ago, by Theophilus Parvin, of Philadelphia, there is a rather comprehensive paragraph with eight quotations from the literature. Since that time but little has been added, except an illustration of a case in Kelly's Operative Gynæcology, published in 1898, Fig. 1, and one by Dr. J. M. Fisher in Volume V of Keen's Surgery. One modern encyclopædic work treats the subject, including operative method, in a five-line paragraph. If the condition is fairly common, it must be that at the present time it is not considered of sufficient importance to gain any prominent notice.

Embryologically this malformation is an arrest of development rather than a redundancy, as the duplicity of parts would suggest. The uterus and vagina are developed from the fusion of the Muellerian ducts, which occurs between the tenth and twelfth week of fetal life. Normally the intervening septum is absorbed, and a single cavity and canal results. Arrest of development in this fusion causes uterus bicornis, septus, or subseptus, which may occur either with or without the persistence of a partial or complete septum in the vagina. When the vaginal septum is obliterated within the hymen, or when one vaginal canal remains rudimentary, the condition may be undiscovered until a bicornate uterus is found during the performance of an abdominal operation. When it is complete it may not be found until labor occurs, or, if the vaginæ are rather small, may be discovered after marriage.

The operative procedures mentioned in the literature are limited to the division of the vaginal septum. Excision with scissors and suture of bleeding points is the method suggested, though Parvin also mentions

*Read before the North Pacific Surgical Association, Spokane, December 17, 1915.

the elastic ligature, and galvanocautery loop. I find no suggestion for the removal of the uterine septum.

Of the two cases that I have observed, one was in a woman forty years of age. The vaginal septum had been excised after marriage, years before, and was evident only as a slight ridge, and an interruption of the normal vaginal rugæ in the middle line. There was a double cervix with a complete septum in the uterus. She had never conceived.

The case which I wish to report in detail was referred to me by Dr. A. Tilzer:

> Patient was married at the age of nineteen and a half years, in April, 1906. Seven weeks later she consulted Dr. Tilzer, who

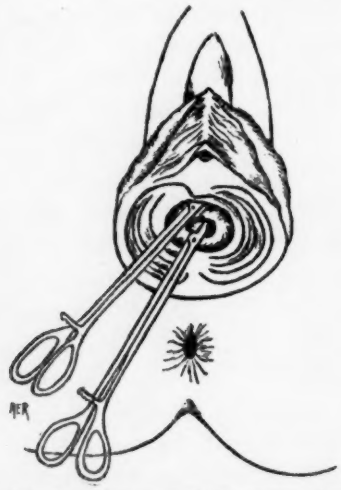

FIG. 2.—Showing forceps placed on septum, and the septum divided between the forceps with scissors.

discovered that she had a double vagina and double uterus. On May 15, 1906, the operation, which I will describe below, was performed. In November, 1908, she was delivered of a normal girl baby; also in July, 1910, of a normal girl baby; on April 24, 1912, a girl baby, breech presentation; on September 9, 1913, a boy. The children were all normal, and living.

The following operative procedure was adopted in this case. Under ether anæsthesia a long straight broad ligament clamp was placed on the posterior part of the vaginal septum, and another on the anterior part (Fig. 2). The ends of both extended to the vaults of the vaginæ. They were firmly clamped, and the septum divided between them with scissors. Two long, straight, right angle retractors were introduced through this incision between

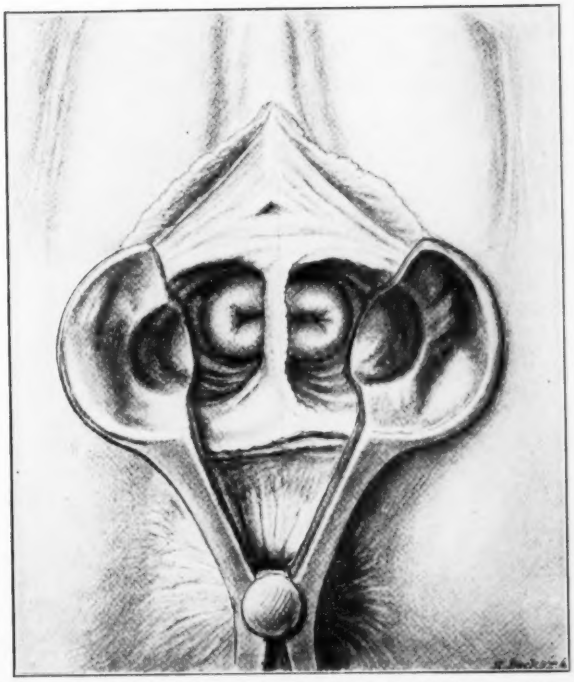

FIG. 1.—Double vagina and double cervix, with a blade of a bivalve speculum introduced into each side so as to show both cervices and the septum in the middle. (From Kelly's Operative Gynæcology, p. 241, vol. i.)

the clamps and the now enlarged vagina, permitting a good view of the double cervix. Exploration by two uterine sounds demonstrated the presence of a complete septum in the uterus. The

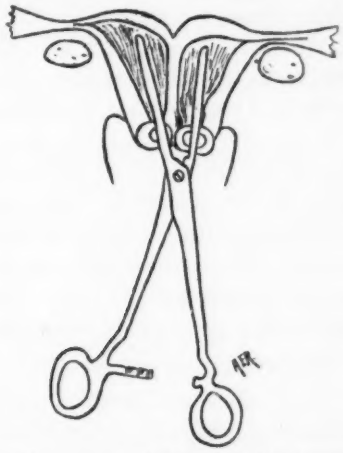

FIG. 3.—Showing one blade of forceps on each side of double uterus, preparatory to destroying the septum by pressure necrosis of the clamp.

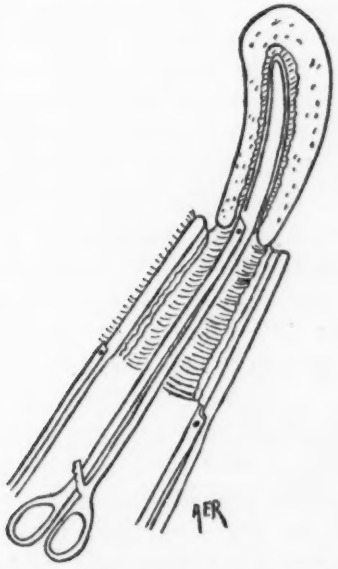

FIG. 4.—Side view of forceps on divided vaginal septum and central clamp fastened to uterine septum.

cervices were separately dilated with a small uterine dilator. This permitted the introduction across the septum of the blades of a full length curved clamp forceps (Fig. 4). This was then firmly

locked into place, compressing the septum (Fig. 3). The handle of this forceps was supported by a folded strip of gauze placed under it in the vagina, and over the perineum, to avoid pressure injury by its weight. In bed the handles of all three forceps were further supported by pads. They were allowed to remain in place for thirty-six hours, and were then removed. The compressed septum soon sloughed out, and healed completely, leaving a single uterus and vagina, that were normal in appearance.

The simultaneous examination of the cavities with two sounds during the performance of this operation is important. The existence of a possible bicornate uterus with a wide low divergence of the bodies should be predetermined. In such a case it might be advisable, after introducing the separate blades of the long curved clamp into the cavities (Fig. 4), to raise the table to the Trendelenburg position, and close the clamp very slowly to avoid any possible injury by catching the intestine between the approximated uterine bodies. In uterus septus, or when, as is usually the case, only the upper part of the body externally is bicornate, no such possibility exists.

By this method the fusion of the two vaginal canals and the two uterine cavities, by forceps pressure, is accomplished with facility and without any bleeding.

INDEX OF TOXICITY OF NOVOCAINE–ADRENALIN INJECTED INTRAVENOUSLY

By Joseph Rilus Eastman, M.D., Bernhard Erdman, M.D.
and
Harry K. Bonn, M.D.
of Indianapolis, Indiana

The use of novocaine-adrenalin in regional anæsthesia is steadily assuming greater clinical importance. Professor Wilms says that in the Heidelberg Clinic, which is known for its large proportion of abdominal operations, in the year 1912, 54 per cent. of all operations were done under local anæsthesia. Through the writings of Braun, Hirschel and Fischer in Germany and of Crile, Harris, Hertzler, Bevan and Allen in America, novocaine has come to be looked upon as the ideal drug for local anæsthesia, almost entirely superseding other relatively non-toxic substances, such as alypin, tropacocaine, stovaine, eucaine and aneson.

The low index of toxicity of novocaine makes it possible to perform under regional anæsthesia more extensive operations than were possible by the methods of Schleich or with any of the older local anæsthetics. M. L. Harris removed the cæcum and ascending colon and made an ileocolostomy, in a person sixty years of age, under novocaine by blocking the ninth, tenth, eleventh and twelfth dorsal and first lumbar nerves on the right side. By Braun's massive infiltration the writers have found it a comparatively simple matter to amputate without pain the leg and arm, to make double amputations of the breast, etc., using novocaine-adrenalin alone. It has not been unusual to employ as much as a gramme of novocaine for one operation, and in the double breast amputation mentioned 1.6 grammes were used.

Hirschel in his book remarks that novocaine "satisfies all the demands which Braun postulates for a local anæsthetic, namely, that the latter should be less toxic than cocaine proportionately to its local anæsthetizing power, that it should not cause any damage to the tissues, that it should be soluble in water and easy to sterilize when in solution, and, finally, that it should be capable of being combined with some adrenal preparation." The fatal dose of novocaine in rabbits when injected subcutaneously is stated by Hirschel to be about 0.73 gramme per kilogramme of body weight, thus the toxicity of novocaine compared with the toxicity of cocaine is as one to seven. Idiosyncrasy

to novocaine has been observed in some individuals. The toxic symptoms, as noted by Laewen, Liebel, Krecke, Hirschel, Fischer and Balzer, are nausea, restlessness, acceleration of the respiration, sweating, pallor, disturbances of vision and deafness. After the administration of large doses, Hirschel has observed clonic-tonic spasms and opisthotonos.

The low toxicity of novocaine when injected subcutaneously having been established by clinical experience, it has been believed by many that the very rare fatalities attending the use of the drug have been due to the injection of novocaine directly into a blood-vessel, usually a vein; for example, a hemorrhoidal vein, a vein of the neck or of the floor of the mouth.

Professor Bier (*Berl. Klin. Woch.*, March 15, 1909) calls attention to the danger of poisoning from intravenous injections of novocaine. Bier's method, as is well known, can be applied only to the extremities. After all blood is expressed from the extremity with the soft rubber bandage rolled from the distal end to a level above the field of operation, a second rubber bandage is wound about the extremity below the field of operation. A subcutaneous vein of this ischæmic segment is exposed and novocaine solution is introduced through a metal cannula. Bier regards 80 c.c. of ½ per cent. solution of novocaine as the largest that can be given with safety, although he has given much larger doses without toxic symptoms. It is well known that the toxic effect of all poisons is more prompt and pronounced after injection directly into the blood stream than it is after subcutaneous or intramuscular injection.

The possibility of serious consequences of intravenous injection of novocaine even in areas rendered quite ischæmic by rubber bandages is suggested by Hitzrot (ANNALS OF SURGERY, October, 1909). After completing operations done under intravenous novocaine anæsthesia, he washes out the veins with warm salt solution as an additional precaution. The upper rubber bandage is then loosened sufficiently to allow the blood to flow through the arteries and thus to wash out more of the novocaine solution. After the blood has flowed for a few minutes he again tightens the bandage and sponges the wound dry and closes it in the ordinary manner. After intravenous injection of novocaine in zones of artificial ischæmia, Bier observed two cases of slight poisoning. In these cases there was dizziness with vomiting but no serious phenomena.

In the animal experiments, reports of which follow, an attempt has been made to determine approximately the index of toxicity of novo-

caine and adrenalin injected intravenously. The injections were made in the marginal ear vein of rabbits. All solutions were warmed before injecting.

Experimental Protocols

I. Intravenous injections of small doses of novocaine-adrenalin chloride in rabbits

Rabbit No. 1.—Weight, 2.15 kilogrammes. This rabbit received a dose of 4 minims of ½ per cent. novocaine (0.0012 gramme) and one minim of 1–5000 adrenalin chloride. Pulse before injection, 156 per minute. After injection rabbit got up at once and walked about. Two minutes after injection the pulse-rate was 102 per minute, and five minutes after injection the pulse was 214 per minute. Respiration was normal excepting immediately prior to the injection, at which time the usual struggling of the animal occurred. This rabbit had no observable reaction of any nature after the lapse of one hour.

Rabbit No. 2.—Weight, 2.35 kilogrammes. This rabbit received a dose of 6 minims of ½ per cent. novocaine (0.00186 gramme) and one minim of 1–5000 adrenalin chloride. Heart-rate, too rapid to count before injection. Two minutes after injection, pulse was 196 and one minute later was 210 per minute. The rabbit remained perfectly quiet and the respirations were irregular. Five minutes after the injection the pulse could not be counted. No further phenomena occurred in the next hour.

Rabbit No. 3.—Weight, 2.5 kilogrammes. This rabbit received a dose of 7 minims of ½ per cent. novocaine (0.00217 gramme) and one minim of 1–5000 adrenalin chloride. Pulse-rate before injection was 174. Respirations were shallow and rapid. Respirations increased in rapidity and became more shallow. The rabbit remained very tranquil. The pulse-rate two minutes after the injection was 90. Within a minute afterwards the rabbit began to move about somewhat. Nine minutes after the injection the pulse was 216 per minute and the rabbit was apparently normal, there being no further change during the succeeding hour.

Rabbit No. 4.—Weight, 2.35 kilogrammes. This rabbit received a dose of 8 minims of ½ per cent. novocaine (0.00248 gramme) and one minim of 1–5000 adrenalin chloride. Pulse-rate previous to injection, 168 per minute. Two minutes afterwards pulse was 300 and the rabbit was very active, running about upon the table. No further change in the next hour.

The same rabbits were used in the following experiment as in the preceding, and numbered similarly.

II. Intravenous injections of novocaine alone (small doses)

Rabbit No. 1.—Received 10 minims of ½ per cent. novocaine solution (0.0031 gramme) diluted with three parts of sterile distilled water. Heart-rate before injection, 136 per minute. One minute after the injection, the heart-rate was 168. There were no symptoms in the next 20 minutes. Twenty-five minutes after this injection the pulse-rate was 168. One-half hour after the first injection 3 c.c. of a ½ per cent. novocaine solution (0.015 gramme) was injected into

the ear vein and two minutes later the heart-rate had dropped to 108; the rabbit remained very tranquil. Three minutes after the injection the heart-rate was 156. The rabbit showed no other disturbance.

Rabbit No. 2.—Received 12 minims of ½ per cent. novocaine solution (0.00372 gramme) diluted three volumes as in the other experiments. The heart-rate before the injection was 174 per minute. Two minutes after the injection the heart-rate was 114 per minute and irregular and the respirations were markedly slow. The rabbit remained very quiet. Three minutes later the rabbit became active, running about over the table.

Rabbit No. 3.—Received 7 minims of ½ per cent. novocaine (0.00217 gramme) diluted as usual. Before the injection the heart-rate was 192 per minute and the respirations were only 30 (very slow for a rabbit).

The second injection of ½ per cent. novocaine (0.00434 gramme) was given two minutes later and almost immediately the heart-rate dropped to 84, no other symptoms being present.

Rabbit No. 4.—Received 55 minims of ½ per cent. novocaine solution (0.01705 gramme) diluted with an equal volume of sterile distilled water. The heart-rate before injection, 136 per minute; one minute later, heart-rate 216 per minute. No other symptoms present.

III. INTRAVENOUS INJECTIONS OF ONE-HALF PER CENT. NOVOCAINE MADE WITH STERILE NORMAL SALT SOLUTION (LARGE DOSES)

Rabbit No. 1.—Received 6 c.c. of ½ per cent. novocaine (0.03 gramme). Heart-rate before injection, 166. Respirations very rapid and very irregular. One minute after injection the heart-rate was 212 per minute. Rabbit remained very quiet and showed no further symptoms.

Rabbit No. 2.—Received 8 c.c. of ½ per cent. novocaine solution (0.04 gramme) in ear vein. Heart-rate before injection, 240 per minute. This was a very thin rabbit. One-half minute after injection the rabbit lying on its back, straightened rigidly. First a partial and then a complete paralysis of fore and hind legs developed. Respirations were extremely rapid and the head was retracted. One-half minute later, or a minute after the injection, the rabbit had recovered the use of both fore and hind legs and was apparently in as good condition as before the injection. The heart-rate was 192.

Rabbit No. 3.—Received 10 c.c. of ½ per cent. novocaine (0.05 gramme) in the ear vein. This was a plump rabbit and the heart-rate before injection was 162 per minute. Within 30 seconds following injection, the head became retracted and the legs extended in complete paralysis. There occurred spastic movements of the entire body and a decided increase in the respiration rate. Some tremors were noticed even during the injection. Finally, there was utter relaxation and the respirations were very slow. Two minutes after the injection had been given we resorted to artificial respiration and a minute later to cardiac massage. Three minutes after injection the respirations were very rapid and the heart-rate could not be counted. At this time there was a very hard circumscribed mass which could be palpated under the ribs and in the region of the heart. We took this to be the heart. Six and one-half minutes after injection, the rabbit was rallying and the heart was 166. One-half hour after injection the heart-rate was 138 and the rabbit was apparently normal.

Rabbit No. 4.—Received 10 c.c. of ½ per cent. novocaine (0.05 gramme) in the ear vein. This rabbit was plump and extremely active. The respirations were very fast and the heart-rate could not be counted before the injection. There was little effect from the injection except a paresis of the hind legs which occurred during the first two minutes following injection. The rabbit crawled about slowly at the time that the paresis was present, dragging the hind legs. Five minutes after the injection the rabbit was tranquil. One hour later the rabbit was apparently normal.

IV. INTRAVENOUS INJECTIONS OF NOVOCAINE ADRENALIN CHLORIDE IN LARGE DOSES

Rabbit No. 1.—Heart-rate before injection, 186 per minute. Received 7 c.c. of a solution containing 10 c.c. of ½ per cent. novocaine (0.035 gramme) and 8 minims of 1–5000 adrenalin chloride in the ear vein. While the injection was being given a convulsion occurred. Within 30 seconds of the time of the injection the following phenomena occurred: The rabbit fell over on its right side with complete paralysis of both front legs and both hind legs and with marked retraction of the head. The eyes bulged and the pupils were enormously dilated. One minute after the injection the rabbit raised its head and a minute later was able to move its front legs. Three minutes after the injection the hind legs were still paralyzed. The respirations at this time were about the same as before the injection. The paralysis of the hind legs was still present nine minutes after the injection and the animal was very unsteady as regards movements of the front legs. Twelve minutes after the injection the rabbit was sitting tranquilly in the same spot where he first sat up and was disinclined to move. A half hour after the injection the rabbit was still in the same posture, but the paralysis of the hind legs had disappeared.

Rabbit No. 2.—Heart-rate before injection could not be counted. Received 10 c.c. of ½ per cent. novocaine solution (0.05 gramme) and 12 minims of adrenalin chloride, 1–5000 solution in the ear vein. Within 45 seconds a convulsion with paralysis of the front legs occurred and one-half minute later the hind legs were paralyzed. The bulging eyes with enormous dilatation of the pupils were present. There was great increase in the heart and respiration rate. The head was retracted and the rabbit frequently shook its head and gave indications of air hunger. During the first minute and a half following the injection, choreic movements were present. Three minutes after injection the head was still retracted, breathing was shallow, all the legs were paralyzed but the rabbit batted its eyes and tried to get up. The rabbit arose six minutes after injection with a partial paralysis of the hind legs. The legs were dragged as the animal crawled about the table. Seven and one-half minutes after injection the rabbit moved about without any trouble and was apparently normal.

Rabbit No. 3.—Heart-rate before injection 252 per minute. Rabbit received 9½ c.c. of a mixture containing 10 c.c. of ½ per cent. novocaine solution (0.0475 gramme) and 15 minims of 1–5000 adrenalin chloride. Injection was given in the ear vein. Thirty seconds after the injection there was marked bulging of the eyes and enormous dilatation of the pupils. There was immediate paralysis of respiration and the rabbit fell upon its side, the head being retracted with complete paralysis of both front and hind legs. The rabbit jerked its head but did not breathe, moving and wrinkling its nose as if air hunger were intense. We were compelled to resort to artificial respiration within one minute

after the injection had been given. The heart stopped 3½ minutes after the injection, but after about 10 seconds of massage of the organ through the chest wall, it began to beat again. Four minutes after the injection there were no observable respiratory movements and the rabbit lay as if dead. Four and one-half minutes after the injection, the rabbit began to bleed from the mouth. The heart-beat could not be detected at this time. Seven and one-half minutes after the injection the rabbit was apparently dead. We opened the chest at this time and found that the heart was still beating. Respiration had ceased.

Rabbit No. 4.—Heart-rate 132 and very irregular before injection. The rabbit received 8.75 c.c. of ½ per cent. novocaine solution (0.04375 gramme) and 20 minims of the 1–5000 adrenalin chloride solution. Within 45 seconds following the injection spasmodic movements with bulging eyes and enormously dilated pupils appeared. Choreic movements were present and air hunger was pronounced. There was a complete paralysis of both front and hind legs, but all four legs jerked stiffly from the trunk, there being no flexion at any joint. The rabbit was very quiet one and one-half minutes after the injection. At this time the respirations were rapid but regular. The heart was so rapid that the rate could not be counted. The bulging of the eyes was not marked. Three and one-half minutes after the injection the respirations were much slower as was likewise the heart-rate, and the rabbit tried to sit up, accomplishing this act with difficulty. There was complete paralysis of the hind legs at the time the rabbit first sat up, the legs being stretched out rigidly. This paralysis passed away a half-minute afterwards.

V. INTRAVENOUS INJECTIONS OF NOVOCAINE ALONE IN LARGE DOSES TO DETERMINE THE LETHAL DOSE IN RABBITS

Rabbit No. 4.—Received 10 c.c. of ½ per cent. novocaine solution (0.05 gramme). Within the first twenty seconds following the injection the rabbit fell upon its back and was shaken with convulsive movements. The head was retracted, the eyes were bulging and the pupils were dilated. Both front and both hind legs were paralyzed. The rabbit wrinkled its nose and kept the mouth open and air hunger was pronounced. Respirations were slow and shallow. One and one-half minutes after the injection the rabbit was apparently normal, moving about upon the table in a lively manner and giving no evidence of the leg paralysis or any other symptoms.

A half hour after the first injection, 30 c.c. of ½ per cent. novocaine solution (0.15 gramme) was injected into the peritoneal cavity without producing any symptoms.

Rabbit No. 2.—Received 15 c.c. of ½ per cent. novocaine solution (0.075 gramme). Twenty seconds after the injection the following symptoms appeared: retraction of the head, the rabbit having fallen upon the back, dilated pupils, bulging eyes, pronounced air hunger, shallow, slow respirations, and the mouth open widely. At this time paralysis of both front and both hind legs was observed. The rabbit sat up four minutes after the injection, paralysis of both hind legs still being present. Five minutes after the injection all symptoms had disappeared and the rabbit was apparently normal.

Rabbit No. 1.—Received 20 c.c. of ½ per cent. novocaine (0.1 gramme). Just as the last 2 c.c. were being injected the respirations stopped, this following immediately upon the phenomena of head-retraction, falling upon the back,

pronounced air hunger and paralysis of all four legs. The mouth remained open and the rabbit made desperate efforts to obtain air. The heart was beating one minute after the injection but the rabbit was apparently dead at this time. Death was deemed to be due to respiratory failure. The heart-beat could be felt two minutes after the injection, but stopped in the following minute. Bleeding from the needle puncture in the ear vein was profuse.

CONCLUSIONS

(1) The index of toxicity of novocaine-adrenalin when administered intravenously in the proportions given above is, as would be suspected, much higher than when given subcutaneously. Hirschel, as was noted, found the fatal dose of novocaine by subcutaneous injection in rabbits to be 0.73 gramme per kilogramme of body weight. If injected intravenously, the average fatal dose in rabbits of novocaine-adrenalin in the usual proportions is probably somewhat less than 0.02 gramme per kilogramme of body weight. In these experiments the lethal dose of novocaine combined with adrenalin chloride when administered intravenously in rabbits was 0.019 gramme per kilogramme of body weight. When using novocaine alone it was observed that the amount of novocaine necessary for a lethal dose was $2^3/_5$ times the dose required when combined with adrenalin chloride, that is, the lethal dose of novocaine alone was 0.0456 gramme per kilogramme of body weight. Thus, the toxicity of novocaine injected intravenously appears from these experiments to be about 16 times greater than when injected subcutaneously.

(2) It was observed that two rabbits died of respiratory failure.

(3) The fatal dose being many times smaller by intravenous injection than by subcutaneous injection, it follows that caution should be employed in injecting novocaine-adrenalin solution that the point of the needle does not enter a blood-vessel, since especially in individuals having idiosyncrasy against novocaine or adrenalin serious harm may be done.

(4) Indifferent dosage and careless use of novocaine solution in subcutaneous injection is inexcusable although in persons not having an idiosyncrasy against novocaine there is a considerable margin of safety if less than two grammes are used.

(5) Since accidental introduction of the solution into a vein may occur during subcutaneous or intramuscular injections of novocaine-adrenalin, the approximate intravenous lethal dose of this combination, that is, 0.019 gramme per kilogramme of body weight should be borne in mind. However, the likelihood of injections by accident of a gramme

or more of novocaine in ½ per cent. solution intravenously must be considered remote, owing to frequent changing of the position of the needle point.

(6) As it is impossible to know beforehand of the existence of an idiosyncrasy, the injection should always be very gradual and cautious. It is prudent to inject a few cubic centimetres of the customary ½ per cent. solution and then wait for 10 or 15 minutes for the development of toxic phenomena which usually appear promptly in individuals having the idiosyncrasy.

(7) Novocaine-adrenalin when injected subcutaneously in the usual proportions and amounts may be regarded as practically safe except in individuals having the idiosyncrasy.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting, held January 3, 1916

The President, Dr. John H. Gibbon, in the Chair

CARCINOMA OF UNDESCENDED TESTICLE

Dr. Charles F. Nassau reported a case of carcinoma of an undescended testicle occurring in a man aged forty-one years, who was operated upon in January, 1912, and is still living, indicating that carcinoma of a testicle is probably not as fatal a condition as sarcoma.

Three months before admission he had an attack of pain in lower abdomen, with inability to empty bladder. Left testicle is not palpable in canal or scrotum. Admitted to hospital June 15, 1912, with another attack of pain in pelvis, with inability to empty bladder. There was a large freely movable firm mass present in the abdomen above the pubes. No testicle could be felt in scrotum or canal on left side. Rectal examination: Large freely movable mass palpable in pelvis.

An incision, 5 inches long, made through left rectus, exposed a large mass which proved to be the testicle. It was delivered, pedicle tied off and tumor cut away. Peritoneum was sewed over the stump. No glands palpable. Appendix was found to be inflamed and it was removed.

The tumor was an ovoidal mass, measuring 10 x 7.5 x 5 cm., weight 547.5 gms. Pathologist report: Scirrhous carcinoma. About the middle of the specimen is a whitish constricting band. The specimen is smooth, moist, glistening and firm to the touch. Incision meets with no resistance, revealing moist, lobulated, glistening yellowish-white tissue. Thin serum can be expressed from the entire surface.

PSEUDO-DIVERTICULUM OF GALL-BLADDER

Dr. George G. Ross gave the history of a woman, aged forty-four years, who, three weeks subsequent to an operation for acute appendicitis, developed an acute cholecystitis. On November 23, 1915, she was operated on through a right rectus incision. The gall-bladder was free from adhesions. It seemed to empty itself on pressure, and outside of

some thickening of the wall did not seem to be badly damaged. As the history and symptomatology, including a cholesterin test, were so positive a cholecystectomy was done. When the gall-bladder was opened it was found to be a typical strawberry bladder at the fundal end. At the fundus near the attachment to the gall-bladder a marsupial-like pouch was discovered. The opening was patulous and the pocket appeared to be about one inch deep. The mucous membrane surrounding the orifice of this pouch was the point of the most intense inflammation.

Pathological examination by Dr. Allen J. Smith. In his opinion this pouch was probably an acquired and not a congenital one. The pouch (not a diverticulum) was over a centimetre in diameter and communicated with the general cavity of the gall-bladder by a short, narrow mouth. It was lined by continuation of the mucosa of the bladder and was the seat of marked hyperæmia. The wall of this pouch of the gall-bladder was incised in the longitudinal line of the pouch; and a portion of the tissue on one side of this incision was prepared for microscopic examination.

On examination one side only (thought to be that which corresponds with the interior of the bladder proper) shows a mucosal surface, thin, with villous prolongations, its epithelium largely desquamated and that which remains low, cuboidal, and degenerative. No such appearance is seen on the opposite (corresponding with the lumen of the pouch) side, this surface being free from epithelium and finely fringed with loosened fibrous tissue (artificial tearing or material?). A layer of smooth muscle underlies the mucosal surface (but not the outer surface) Beyond this muscle the tissue to the free surface (of pouch?) is made up of a loose fibrous tissue. The latter is not as dense as one is accustomed to see in a scar but might have been produced by inflammatory change.

The general appearances can be best tentatively explained by supposing that an inflamed and ulcerous surface has had overhanging mucosal borders, that these later adhered to the interior of the pouch thus formed, healed, with a persisting track into the gall-bladder, but the epithelium of the gall-bladder failed to grow into and line the cavity.

FOREIGN BODY IN ELBOW-JOINT (MOUSE)

Dr. Ross presented a man, aged thirty years, who two years ago while pitching ball says he felt something crack in his elbow. He had to stop pitching for the rest of the season. The following season he pitched some although his elbow continued to hurt him. About four months ago he bumped the elbow and felt something loose, after this, in

FIG. 1.—Pouch of gall-bladder.

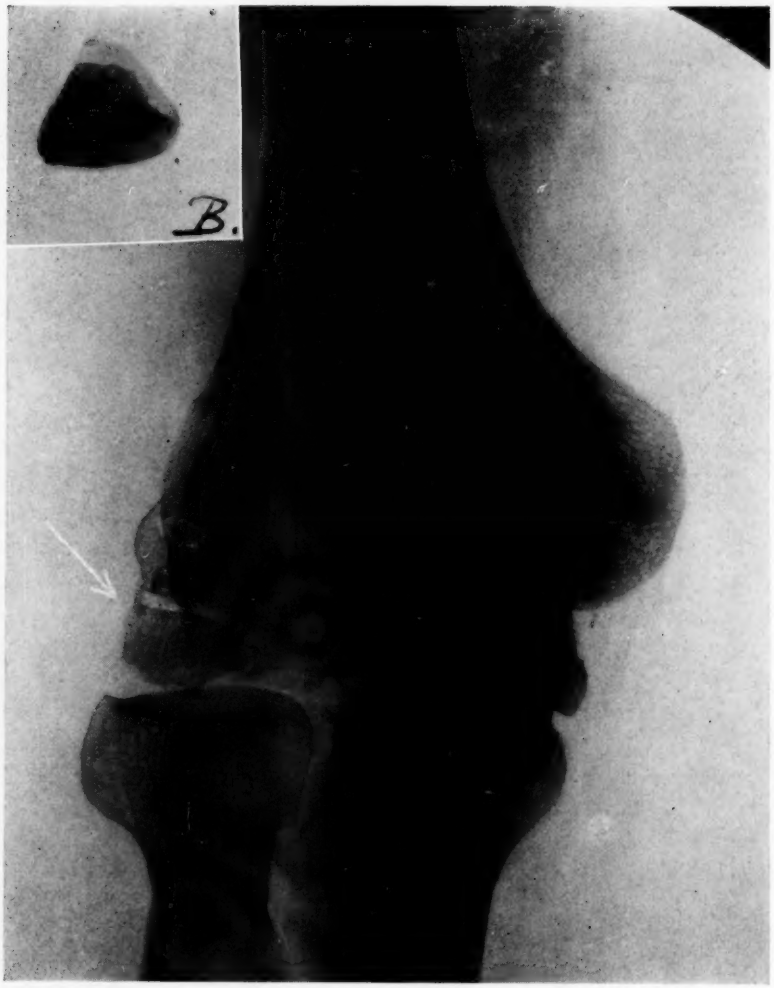

FIG. 2.—Bit of the external condyle broken off, and forming a loose body in the elbow-joint. *B.* the fragment removed.

the outer side of the joint. An X-ray of the elbow a week ago showed a fracture of the external condyle of the humerus. On the outer side of the elbow just above the joint can be felt a small movable body about the size of a hazel-nut. This is hard and slips when the arm is moved.

Through an incision made over the mass it was easily found and removed. It proved to be a piece of bone the size of a hickory nut, covered with cartilage. It was unattached and was to the outer side of the external condyle.

A perfectly normal functional result was secured.

Dr. John H. Jopson said that Dr. Ross's case of "joint mouse" belongs to that group of cases of fracture of the capitellum which has been especially studied by Kocher and Lorenz, to which he alluded in his paper on that subject published two years ago, and called by them "fractura capituli humeri partialis," in contradistinction to the larger group of fractures of the capitellum in which there is a splitting off in whole or in part of that articular prominence. In the first group the injury partakes of the nature of partial or complete avulsion of the cartilage covering the capitellum, to which portions of the spongy tissue of the bone may also adhere. Kocher has reported four cases and Lorenz two cases of this injury.

It is of infrequent occurrence and in the majority of cases is due to indirect violence, possibly, as Kocher points out, by traction through the anterior capsular attachments pressing backward on the cartilage and prying it off, as when the injury occurs while lifting with the forearm extended. The X-ray shows, as in Dr. Ross's case, irregularity in outline of the normal shadow of the capitellum. Treatment, of course, is by incision and removal of the fragment, which in all of the cases reported has given uniformly good results.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

Stated Meeting, held January 26, 1916

The President, Dr. Chas. N. Dowd, in the Chair

TRANSPERITONEAL NEPHRECTOMY FOR CONGENITAL MIXED TUMOR OF THE KIDNEY

Dr. Edwin Beer presented a woman, aged twenty-two years, who for three years had suffered every few months from cramp-like pains in the right lower quadrant of the abdomen. At the same time had noted the presence of a tumor in the right half of the abdomen. She had lost twenty-two pounds in weight. The tumor had not increased in size, and when admitted the tumor was found to extend well across to the mid-line of the abdomen and to lie external to the colon.

April 24, 1915, Dr. Beer operated by the transperitoneal route for the removal of the tumor-bearing kidney. A seven-inch, rectus-splitting incision exposed the tumor. The peritoneum over the tumor was widely incised, and then pushed aside, exposing the ureter and the vascular pedicle. These were carefully ligated and then the tumor dissected free. No metastases in glands, liver, or vessels detected. Patient made an uneventful recovery and was discharged on May 8th.

Note.—When this method of approaching giant tumors of the kidney was first suggested (Israel, etc.), it was thought that by getting at the pedicle at once all chance of dislodging pieces of growth that had invaded the renal veins would be avoided. This method of approach does, in a measure, accomplish this, although usually considerable manipulation must precede the location and ligation of the pedicle. That it is, however, a much simpler method of approach for these very large tumors than the lumbar route no one, who has had experience with both, will deny. It allows of search for intraperitoneal deposits, it allows of earlier ligation of the vessels, it gives much better exposure throughout the operation, and in case a deposit has grown into the vena cava it can be more readily extracted.

HYPERNEPHROMA COMPLICATED BY PREGNANCY; NEPHRECTOMY

Dr. Beer presented a woman, aged thirty-two years, who since three years had known of the existence of a tumor in the right hypochondrium, which had doubled in size during the last year. She was over four months advanced in pregnancy.

Examination showed a symmetrical tumor in the hypogastrium corresponding to a four-months pregnancy, and in the right side of the abdomen a very large, slightly nodular, mass, which ballotted from the lumbar region and was slightly movable. The large nodules on the anterior surface were somewhat cystic to touch and suggested the possibility of a cystic degeneration.

June 3, 1915, a transperitoneal nephrectomy was done through a six-inch, muscle-splitting, right-rectus incision, exposing the tumor. The posterior parietal peritoneum over the tumor was incised widely and pushed back from over the tumor, exposing the ureter and the vascular pedicle. These were carefully ligated, the latter close to the vena cava, which, as well as the renal veins, was not involved. The whole mass was then readily delivered and the posterior peritoneum was closed by suture. Layer suture of the anterior incision, without drainage. The patient made an uneventful recovery and went to term, having a normal labor.

Pathological report: hypernephroma.

HYPERNEPHROMA COMPLICATED BY APPENDICITIS AND LUES: NEPHRECTOMY

Dr. Beer presented a woman, aged thirty-eight years, who one year ago began to suffer dull and constant pain in right lower abdomen, and she noted in this region a hard mass which has not altered in size. In addition to the dull pain, attacks of severer pains, lasting four to five hours, soon set in, and these were accompanied with frequency of urination. About four months prior to admission serpiginous ulcers appeared on the right leg and responded to local treatment very slowly.

Physical examination showed a very pale woman with Hb 65 per cent. In the right half of the abdomen was a slightly irregular, ovoid mass the size of an adult head. It was movable from side to side about one inch, and a little more so in the vertical direction. On the right leg there were several definitely specific ulcerations. The Wassermann was strongly positive.

On the strength of the examinations the diagnosis rested between a specific renal involvement and a neoplasm. Just prior to operation the patient had severe attack of right iliac pain which was thought to be due to the renal condition, but proved on operation to be due to an acute appendicitis.

June 5, 1915, transperitoneal nephrectomy and appendicectomy were done. Seven-inch, rectus-splitting incision and peritoneum opened. Acutely inflamed appendix seen in lower angle and removed. Peri-

toneum over the kidney mass opened and stripped back so as to liberate the mass. There was some difficulty in pushing the hepatic flexure off the mass. It was flattened out over and adherent to the tumor. The posterior surface of the huge tumor was slightly adherent in its bed, making it rather difficult to free. Early in the dissection the ureter was exposed and doubly ligated and then the broad vascular pedicle which was not involved was ligated, so that subsequent manipulations would not force any neoplastic tissue into the circulation. Vena cava was widely exposed and found free. Tumor and perirenal fat were removed *en bloc*.

The recovery was uneventful and on June 17 another phthalein test was made and 56 per cent. recovered in two hours. In other words, after removing the right kidney the left was working better than at the previous examination.

Pathological report showed the mass to be a hypernephroma.

DR. CHAS. N. DOWD said that the transperitoneal method of nephrectomy is surely more complicated than the retroperitoneal method, but the advantage of early pedicle ligation in cases of malignancy should be considered. It would be interesting to hear the experiences of other members of the society with this method.

DR. WM. A. DOWNES said that he had only removed one kidney through the anterior incision. Most of the large kidney tumors that he had had, had been in children. He had used the transverse incision practically altogether, and had found this incision very satisfactory. The pedicle has never given any trouble. The metastasis question is, of course, a very pertinent one in all of these cases. He had frequently found that there were masses leading from the renal vein to the vena cava. All but two of eleven cases had died from a general metastasis, which has occurred very quickly.

He asked whether, in exposing these tumors transperitoneally, the presence of large retro-peritoneal veins which run across the tumor add to the dangers. He asked this because about three years ago at a meeting of the Society, at the New York Hospital, he showed a woman from whom he had removed a large adenocarcinoma of the kidney which had been previously exposed by an anterior incision. The surgeon who did the first operation encountered veins so large that he feared that a hemorrhage would probably be fatal, and did not attempt to remove the kidney. The woman went away and in a month or two came back and said that she was still greatly troubled by the tumor. When approached from the back it was removed without difficulty.

DR. HOWARD LILIENTHAL thought that Dr. Beer had brought up an important point when he discussed the propriety of removing the hypernephromatous kidney when there are secondary growths present. He believed that modern authority has it that even in the presence of metastases the kidney should be removed when, through hemorrhage or pressure, it threatens the life of the patient. Operable secondary growths should also be extirpated. About a year ago Dr. Lilienthal removed a hypernephromatous kidney from a woman who had a large metastasis in the dome of the liver. She has remained well up to the present time, although naturally the metastasis is still present. It is difficult to judge of the malignancy of these tumors, and particularly of certain metastases. He had seen one patient, for example, who lived for three years with a metastasis in his right femur. When there is an obviously terminal condition with cachexia no operation can do good, but the mere presence of secondary tumors should not necessarily deter us from performing a nephrectomy with the object of prolonging life.

DR. BEER, in closing, said that he had had no trouble at all from the colic vessels. Of course, the posterior peritoneum, if uninvolved, usually strips off the tumor very readily. If one gets in the right cleavage line, one can push back all the vessels with the gut, just as in extensive colic resections. As far as children are concerned, it depends upon the size of the growth, as to the line of approach. These giant tumors do not look very large when they have shrunk outside of the body, but in one of these cases, the X-ray shadow fills the whole right side of the abdomen and extends two inches across the median line into the left half of the abdomen. It is practically impossible to deliver such a growth through a lumbar incision, as there is not sufficient space between the iliac crest and the ribs. Consequently, even in children, he would use the transperitoneal approach through a vertical incision. The important points are to determine whether there are secondary intra-abdominal deposits, as well as to get at the pedicle with as little manipulation as possible. Recently, in one of these enormous tumors, filling the whole left side of the abdomen, a case of (microscopic) hypernephroma, he found a huge secondary deposit in the dome of the left lobe of the liver. He immediately closed the patient's wound. There was no object in removing the large primary growth together with the involved splenic flexure. If one makes a big enough transverse cut one can open the peritoneum and explore, but not as readily as through an anterior incision. Moreover, in this approach, the vascular pedicle is reached late, and whatever the advantage of tying off this

pedicle early may be, it is surely lost if extensive manipulations precede the ligation, as is the case in all lateral and lumbar incisions.

THE IMMEDIATE REDUCTION OF FRACTURES

DR. WILLIAM DARRACH read a paper with the above title, for which see page 593.

DR. HOWARD D. COLLINS said that one must bear in mind that, in the early reduction of fractures, if a plaster-of-Paris dressing is to be applied at once, one must allow for subsequent swelling. It will occur, and one must put that splint on much looser than one would in the ordinary cases where the fracture is reduced at the end of three or four days. In his experience, he had to cut down plaster more frequently in the early reductions than in the later reductions, simply on account of his own omission to note the importance of leaving plenty of room.

DR. ARTHUR S. VOSBURG said that the way he used to get around the difficulty of the swelling which is apt to follow is, after making reduction, and if a circular incasement of plaster is to be used, he splits it down with a scalpel at the time, before the splint hardens, to allow for any subsequent swelling. The encircling plaster cast will gape, if any swelling occurs in the next forty-eight hours, and any subsidence of the swelling can be met by drawing the split cast together with adhesive straps.

DR. LILIENTHAL said that, in taking into account the swelling in cases of fracture, much depends on just how early the injury is seen. In performing osteoclasis or linear osteotomy for bow-legs, for example, or for some other deformity, surgeons are accustomed to apply immediately a firm compressing dressing taking in the entire limb from the most distal part to a point well above the fracture, and yet they do not fear the swelling. If a case of fracture of a long bone is seen soon after the injury and before swelling has occurred, it may be treated in much the same manner as would be employed in a case of osteoclasis.

Another point, though perhaps not quite germane to the question, is the matter of ambulant treatment, more particularly in fractures of the leg. It has been his procedure to employ a Hessing splint as soon as the apparatus can be made. With this splint a patient with Pott's fracture can be walking about within a very few days. Owing to the expense of this appliance the method is not applicable to the usual hospital cases, but in private practice it is most satisfactory. His results have been good. The treatment of every case, however, depends

on the circumstances which surround it and there can be no hard and fast rules. In children with fractures of the arm or forearm pressure should not be used because of the danger of ischæmic paralysis.

Dr. Beer said that immediate reduction, that is, proper immediate reduction, complete reduction, is not as easy of accomplishment in certain bones as in others, and under present conditions is not always possible. One has, therefore, to differentiate between two types of cases. In fractures around the wrist or a fracture in some part of the hand, or a fracture around the ankle, where the bones can very readily be felt through the overlying skin, an immediate complete reduction can be secured. But in fractures which are surrounded by heavy muscles, fractures of the humerus, of the thigh and the like, it is much more difficult to obtain complete reduction, as the bones can not be definitely palpated. Their immediate reduction is also indicated, but it should be done under the control of the fluoroscopic screen, as otherwise reduction will frequently be incomplete and unsatisfactory. In order that one may get immediate complete reduction in both classes of cases, every one of our large hospitals (Bellevue Hospital, particularly, where fracture material comes in such quantity) ought to have a special X-ray room for fracture cases, so that a patient can be put under an anæsthetic and have his fracture promptly reduced under fluoroscopic control, instead of waiting for X-ray plates made at the convenience of the X-ray laboratory. Under the system in vogue, plates are taken first, then reduction is made, then re-X-ray, and if position is unsatisfactory, re-reduction.

Dr. Joseph Wiener said, judging from the discussion, plaster-of-Paris seems to be the only method of treating fractures. Personally, he had not used plaster-of-Paris for over ten years. He did not expect to use it for the next ten years. He had been using what we call "starch and veneer dressing." It is astonishing how little it is known. This starch and dextrin can be bought in yard widths and cut down into bandages and made with an ordinary bandage roller. The veneering one must get from a piano factory. When that is wet, it can be moulded accurately to shape any part of the extremities of the body. There is no danger of any constriction. There is no danger of paralysis, and the didactic rules that Dr. Connell rightly laid down in the use of plaster-of-Paris fall away completely. Furthermore, the difference in weight is perfectly marvellous. He had numerous patients who had had fractures of the leg and thigh treated with plaster-of-Paris and subsequently been treated with this. They call the first treatment barbarous and the second treatment delightful.

Dr. Wiener also presented two cases in which there was no immediate reduction of the fracture, to show what might be done subsequently. The first case was a little girl of five years who was in the hands of a practitioner of the old school. The little girl fell on the street about three years ago. When the doctor saw her about two hours later there was a good deal of swelling in the knee-joint and there was a good deal of bruising of the soft parts, and he made a diagnosis of injury to the knee-joint. He kept the child in bed for about ten days with ice-bags. The swelling in the joint went down, the pain subsided. After about two weeks he allowed this child to get up. The child then was unable to walk. The mother noticed it, became very much alarmed, and asked for further advice. The speaker then saw the case, about two weeks after the injury. Measurements showed a shortening of about an inch and a quarter of the lower extremity on the injured side.

The child had a transverse fracture of the femur, with little callous formation. It was still possible to separate the ends of the bone without much difficulty, and a rather powerful assistant could pull the lower fragment down. The moment he let go, the lower fragment snapped back. To keep the bones in place he put in a Lane plate in the child's femur. The wound healed by primary union. There was a great deal of callus formed. The child is still carrying the plate. The child is still absolutely well and free from all symptoms.

The second case is a case which is still under treatment. Two and a half weeks before admission he was struck by a trolley car, which hit him in the left arm. The car, going at full speed, knocked him down. He was dazed. When he recovered, he found he didn't have the use of his left arm and there was pain and swelling of the arm. He went to a dispensary, where his arm was put up at a right angle with an immobilizing dressing. No attempt at that time was made at reduction. The man's pain got worse instead of better and when he entered the hospital he had a flexion angle of fifty degrees, an extension angle of twenty. Palpation showed the distal fragment on the inner side of the arm, about three inches above the elbow. The proximal fragment could not be made out, but the distal fragment was almost under the skin.

On January seventeen, two and a half weeks after the injury, an incision was made on the outer aspect of the arm and a large, loose piece of bone removed. There was a small piece of bone with some periosteum attached, which was left in place. Much difficulty was experienced in overcoming the deformity. The bones overlapped con-

siderably and there was a very marked flexion of the lower fragment. He resected about three-eighths of an inch from the ends of the fragments and put in an intermedullary splint taken from the tibia.

Dr. Karl Connell remarked that it was to be regretted that the hospital routine of obtaining scientific data occasionally works to the detriment of the patient. This has occasionally happened in the treatment of fracture at the Roosevelt Hospital clinic. Not infrequently, in an effort to record the primary malposition by X-ray, the reduction of recent fracture would be delayed for twenty-four hours or more. There is no clinical advantage if it involves delay, in waiting for X-ray before reducing the average fracture of the wrist and ankle. He believed they should be promptly reduced and the resultant position only recorded. It certainly works for the ease of reduction, the comfort of the patient and more rapid recovery of full function of the soft parts, to reduce promptly.

As to the circular plaster splint, while this is the most economical distribution of material for strength and immobilization, yet no circular plaster splint on recent fracture of the forearm or leg should be left completely encircling the limb after it hardens, but the freshly applied circular splint should be cut down in a line to allow it to gape in case the limb swells. To the student we lay down the pedagogic rule, that not only shall the circular plaster splint when applied over recent fracture be split its entire length, but that every shred of circular bandage beneath shall be entirely cut through. He had seen some very unfortunate results from ischæmic contracture following the violation of this rule.

Dr. Seth M. Milliken remarked that, of course, the grossly open fracture with projection of the entire fragment is to be treated conservatively, usually; but so many fractures are opened by a slight puncture of the bone, making a small pin-hole in the skin. It seemed to him that those should be treated by the immediate reduction, just as the closed fracture. It is easy to get a fresh fracture back into place. After it has started, it seems to snap in anatomically. It is hard to do it the next day or after the X-ray is taken. As far as dressings are concerned, on the forearm and on the leg, the moulded splint may be accurately applied. It hardens very rapidly. There is no internal circular layer to be cut down. The only circular layers are the outside bandage, which can be cut as soon as the patient begins to complain of pain, which is very rare after they are properly reduced. After the fracture is reduced, the patient is easier and the swelling diminishes. But, with the moulded splints, if there is any continued swelling, the

bandages are easily split and the new bandage put over that without displacing the fragments or splints.

DR. CHAS. N. DOWD remarked that, whenever the question of operating for fractures in children arises, he felt like referring to the valuable work which Dr. Truesdell, of this city, has done on the subject. He has taken series of X-ray pictures of very young children who had excessive deformity after badly united fractures. The results showed a marvellous power of adjustment. Even when excessive angular deformity existed the ultimate result was almost perfect. Children have far better power of overcoming fracture deformity than adults have.

ELBOW DISLOCATION TREATED AS A FRACTURE

DR. SETH M. MILLIKEN presented a man, with a history as follows: twenty-five years old, a fireman. The engine wouldn't start on a self-starter, so he started to crank it, when he felt a kick and a severe pain in his elbow. He was seen by the ambulance surgeon, who applied a posterior splint to the arm, in complete extension, and was admitted to the division as a fracture about the elbow for X-ray. On examination, there was a perfectly obvious posterior dislocation. There was no fracture evident or to be made out. The reduction was very easy by straight traction and it snapped in with an audible click. The X-ray, subsequently made, shows no bony lesion.

He had two reasons for bringing this elbow dislocation before the Society. One was the rarity of the cause of the injury, and the other was that this is the second case within a month where a dislocated elbow has been sent in as a fracture, and in both cases splints applied. The first case had a chicken-wire, moulded splint in a child of fourteen, extending about an inch and a half below and about an inch and a half above the elbow joint. That was an external dislocation in which the head of the radius stuck out just as plainly as one's thumb.

In the case of this man, there was absolutely no injury received to any part of the arm, except that, of course, transmitted through his palm.

DR. DOWD also had had a case of dislocation of elbow this year which had been treated as a fracture, and he had great difficulty in reducing it. The dislocation had existed for five weeks when he saw it. It was impossible to reduce it without incisions, external and internal; and even then much force and the use of metal levers within the joint were necessary. There is still much limitation of motion.

BOOK REVIEW

ORAL SURGERY, A TREATISE ON THE DISEASES, INJURIES AND MALFORMATIONS OF THE MOUTH AND ASSOCIATED PARTS. By TRUMAN W. BROPHY, M.D. P. Blakiston's Son & Co., 1012 Walnut Street, Philadelphia.

THIS book of Dr. Brophy's is an encyclopædia of information concerning those subjects directly and remotely connected with oral surgery. The first sixteen chapters cover general considerations which are introduced into this book because of the need felt that the dental student should be especially well informed upon these matters. These subjects concern surgical bacteriology, special infections, syphilis, tuberculosis, the subject of immunity and serum therapy, the general subject of tumors, destructive processes, wounds, antisepsis and asepsis, hemorrhage, anæsthesia, injuries and diseases of blood-vessels, fractures and dislocations in general, diseases of bone, the examination of the blood, the surgical engine and its use in bone surgery, the latter a chapter written by Dr. Cryer, of Philadelphia.

It is of value to the dental student to have assembled in a book devoted to dental surgery these various subjects common to all surgery. If the dental student is familiar with broad principles he will the more intelligently care for his special group of diseases.

The following nine chapters deal with matters concerning the mouth and its contained anatomy, the tongue and tonsils. In these chapters fractures and dislocations of the bones of the face and lower jaw are considered, ankylosis of the temporo-mandibular articulation, and the diseases of the antrum of Highmore.

The following three chapters, covering over two hundred pages, have to do with harelip and cleft palate. No surgeon in this country is better qualified to present these particular subjects than Dr. Brophy. That which stands out in this encyclopædia as the special original communication on the part of the author are these pages devoted to harelip and cleft palate. The chapters are attractively written, are thorough in their review of the subject and leave upon the reader's mind an impression of authority which is most stimulating.

Then follow two chapters, one by Dr. Calvin S. Case, upon the mechanical treatment of congenital cleft palate, and one by Dr. G. Hudson-Makuen, upon the training of speech after cleft palate operations. This thirtieth chapter upon the training of speech after cleft

palate operations is most timely. It is coming to be recognized that speech training after cleft palate operations is very important. A recognition of this importance in training is shown by the fact that at the Massachusetts General Hospital recently there has been established a clinic in connection with the Throat Department for the training in speech of those upon whom cleft palate operations have been done.

The chapters which close the book have to do with the teeth, and with the transplantation of teeth, this latter being described by Dr. Wm. J. Younger, of Paris, France.

Two chapters are devoted to a description of the cysts occurring in the jaws and tumors of the jaws. These two chapters upon cysts and tumors are intended to give the student a clear idea of these pathological processes.

Chapter 37 is devoted to trigeminal neuralgia, Chapter 38 to the salivary glands, Chapter 40 to prosthesis, and Chapter 41 to infant feeding, written by Dr. F. W. Belknap.

The final three chapters have to do with the ligature of arteries about the head and face, with prognathism and diseases of the lips. Then follows a well-arranged index to the book.

This book of Dr. Brophy's is a valuable contribution to the literature of Oral Surgery. The very comprehensive way in which the subject is presented is of especial value to the dental student and in general to the dental practitioner. It is obviously impossible to criticise the presentation of each of the important subjects. For the purpose of this review it seems to me sufficient to say that the book is well conceived and meets a need of the dental student. In connection with the subject of oral surgery it presents the modern conception of disease and gives the recent and good suggestions for treatment. The book is profusely illustrated, and these illustrations are helpful and attractive. However one may differ with Dr. Brophy in the methods of treatment advocated in certain conditions, the fact remains that he has contributed a most interesting book to the literature of this subject. It is a good book of reference.

CHARLES L. SCUDDER.

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